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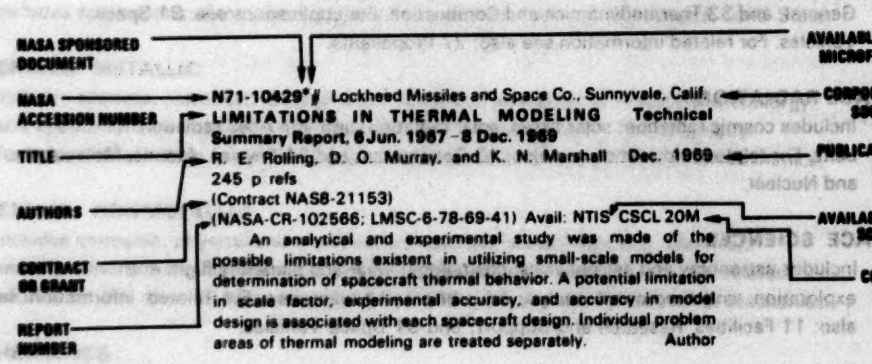
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 1 / JANUARY 8, 1971

Scientific and Technical Aerospace Reports

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-10339# Advisory Group for Aerospace Research and Development, Paris (France).

BIBLIOGRAPHY OF DOCUMENTS CONTAINING NUMERICAL DATA ON PLANAR LIFTING SURFACES

R. Dat Aug. 1970 63 p refs

(AGARD-R-574-70) Avail: NTIS

The material presented covers the years 1951 to 1968, in chronological order, and lists documents that are unsuited to systematic classification but which nevertheless make a considerable contribution to the literature on unsteady aerodynamic forces. Emphasis is placed on experimental results and on comparisons between theory and experiment. Program descriptions, which may be useful as guides, are presented and abstracts include the nature of the results and their importance. Captions indicate the speed range, whether the results are theoretical or experimental, whether control surfaces are considered, and whether pressure distributions are given. Consideration is limited to planar surfaces and to calculations resulting from the general formulation of the problem. Author

N71-10411*# National Aeronautics and Space Administration.

FORTRAN PROGRAM FOR COMPUTING COORDINATES OF CIRCULAR ARC SINGLE AND TANDEM TURBOMACHINERY BLADE SECTIONS ON A PLANE

William D. McNally and James E. Crouse Washington Nov. 1970 48 p refs

(NASA-TN-D-6020) Avail: NTIS CSCL 21E

A FORTRAN 4 program is presented which computes and plots coordinates for circular arc blade sections on a plane. Either single blade sections or tandem blade sections with up to 5 segments can be designed. Surfaces of blade segments consist of single circular arcs. The arrangement of segments on the plane is a function of the input parameters. These parameters are overall blade section quantities such as chord, camber, and solidity, as well as individual blade segment parameters such as chord, camber, gap between blade segments, overlap of segments, maximum thickness, and leading- and trailing-edge radii. Author

N71-10467*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FORTRAN PROGRAM FOR CALCULATING AERODYNAMIC FORCES FROM PRESSURE OR VELOCITY DISTRIBUTIONS ON BLADE SECTIONS

William D. McNally Washington Nov. 1970 38 p refs

(NASA-TM-X-2123; E-5652) Avail: NTIS CSCL 01A

A FORTRAN 4 program is presented which calculates aerodynamic forces on turbomachinery blade sections from distributions of pressure or velocity along the surfaces. Blade sections for which forces are calculated may have either one blade segment or two segments (tandem blades). Input includes blade surface coordinates, surface distributions of pressure or velocity, and several overall flow parameters. Surface angles may also be given as input, or may be computed by the program from spline curves. The program integrates pressure or velocity distributions to obtain components of force on the blade surfaces. Meridional and tangential forces and lift and drag forces are then computed. For tandem blade sections, ratios of forces on rear blade segments to forces on front blade segments are also given. The program is particularly useful in conjunction with existing ideal flow programs which allow the analytical study of blading. Author

N71-10562# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.

RESEARCH ON THE FLUTTER OF AXIAL-TURBOMACHINE BLADING Semiannual Status Report

Fernando Sisto and Ron Ho Ni Jun. 1970 39 p

(Contract N00014-67-A-0202-0016)

(AD-710794; ME-RT-70004; SASR-2) Avail: NTIS CSCL 10/1

Theoretical and experimental pheses of a program to study flutter in turbomachinery blading are summarized. The analytical model serves mainly to describe the unstalled, linearized baseline from which the large amplitude, possibly stalled data may be compared. The effect of significant parameters on quasistatic aerodynamic moment is displayed and generalized conclusions are drawn. Author (TAB)

N71-10581# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

SUBCRITICAL FLOWS OVER TWO DIMENSIONAL AIRFOILS BY A MULTISTRIP METHOD OF INTEGRAL RELATIONS

R. E. Melnik and D. C. Ives Oct. 1970 10 p refs Presented at the 2d Intern. Conf. on Numerical Methods and Fluid Dyn., Berkeley, Calif., 14 Sep. 1970

(RE-393J) Avail: NTIS

The possibility of using Dorodnitsyn's method of integral relations (MIR) to treat this classical nonlinear potential flow problem is considered. The scheme 1 version of the method is employed, in which the strip boundaries are taken more or less parallel to the airfoil surface. This scheme is considered to be best suited for airfoil type problems in which the rapid variations are along the airfoil surface. The chief advantage of MIR is that,

because a relatively coarse mesh can be taken across the flow field, useful solutions can be obtained with less computer time than might be required by other methods. This approach offers the possibility of developing an economical calculation scheme for practical airfoil design. Author

N71-10832# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF THE RECIRCULATION REGION OF A FLOW FIELD CAUSED BY A JET IN GROUND EFFECT WITH CROSSFLOW Final Report, 19 Mar. –30 Apr. 1970
T. W. Binion, Jr. AEDC Sep. Spe. 1970 31 p refs
(Contract F40600-71-C-0002)
(AD-711665; AEDC-TR-70-192) Avail: NTIS CSCL 20/4

A wind tunnel investigation was conducted in the Low Speed Wind Tunnel (V/STOL) to determine the velocities in the recirculation region of the flow field produced by the interaction of a jet impinging on a ground plane with crossflow. Axial and vertical velocity component measurements were obtained with a forward-scattering laser Doppler velocimeter. Test results provide two-component velocity fields and indicate that the jet-to-free-stream velocity ratio is much more important in determining the flow field than the magnitude of the individual velocities. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-10052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF A SERIES OF TWIN-KEEL ALL-FLEXIBLE PARAWINGS
Rodger L. Naeseth Washington Oct. 1970 103 p refs
(NASA-TN-D-5936; L-7096) Avail: NTIS CSCL 01C

Low-speed wind-tunnel studies were made to obtain the static aerodynamic characteristics of a series of 10 twin-keel all-flexible parawings. The parawings, in flat planform, had a leading-edge sweep angle of 45 deg and generally a 20-percent keel length cut off of the apex of the basically triangular shape. The nose of each parawing model was contoured in such a manner that the airfoil sections in the center panel of the model had rounded leading edges. Twin-keel parawings were found to have improved performance characteristics as compared with single-keel parawings. The maximum lift-drag ratios of the models ranged from 2.6 to 3.2. Results of a limited flight-test program indicated that the twin-keel parawings would glide when the rigging, except for control-line length, was set as determined in the small-scale wind-tunnel tests. Author

N71-10094# Hydrospace Research Corp., Rockville, Md.
PENETRATION OF SONIC BOOM ENERGY INTO THE OCEAN: AN EXPERIMENTAL SIMULATION Final Report
John F. Waters and Ray E. Glass Jun. 1970 55 p refs
(Contract N00014-70-C-0374; FA-70-WAI-185)
(AD-711963; HRC-TR-288) Avail: NTIS CSCL 1/1

Penetration of sound into a body of water from a simulated airborne sonic boom was measured in an acoustically scaled experiment. Dynamite caps were used to produce spherically spreading N-waves which impinged upon the water. Microphones at the water surface and hydrophones at various shallow depths were used to measure the exponentially attenuating penetration of the airborne pressure field into the water, under total reflection conditions. Agreement between the scaled experimental measurements and predictions based on existing theory was generally good. Application of the theory to the case of actual sonic booms impinging upon the ocean, and comparisons with measurements of typical deep-ocean ambient noise, indicate that underwater sonic boom noise will be discernible only at very low frequencies and at shallow depths. Pressure fluctuation spectrum levels due to surface waves will be higher than levels due to sonic booms. Author

N71-10115# National Transportation Safety Board, Washington, D.C.
SYSTEMS APPROACH TO ACCIDENT INVESTIGATION
C. O. Miller [1969] 22 p refs Presented at Flight Safety Found. Ann. Seminar, Montreux, Switz., 28 Oct. 1969
Avail: NTIS

The complex aerospace world has generated a systems management methodology to efficiently and effectively achieve stated objectives in accident investigation. The systems approach to accident investigation is discussed, wherein the resultant process is referred to as accident inquiry management. Author

N71-10122# Naval Postgraduate School, Monterey, Calif.
COMPUTERIZED AERODYNAMIC OPTIMIZATION OF AIRCRAFT PROPELLERS
Robert Linford Shaw (M.S. Thesis) Jun. 1970 102 p refs
(AD-710356) Avail: NTIS CSCL 1/3

The objective of the thesis was to develop a practical computer system for use of empirical data in the aerodynamic optimization of aircraft propellers. The system was designed for use with the IBM 2741 on-line computer terminal. This program provides instructions to the operator during execution, and allows interaction by the operator for input and alteration of data, and for program instructions. The Lockheed P-3C aircraft was chosen as the subject for test and evaluation of the program. The currently operational propeller of this aircraft was tested to compare the programs prediction of aircraft performance against flight test information. An attempt was then made to select a propeller which could provide better performance under the same constraints as those imposed in design of the operational propeller. Author (TAB)

N71-10171# Department of Transportation, Washington, D.C.
FIRST FEDERAL AIRCRAFT NOISE ABATEMENT PLAN, FY 1969 –1970
Nov. 1969 79 p refs
Avail: NTIS

The reduction of aircraft noise is studied for achieving compatibility between airports and the adjacent metropolitan environs. The sonic boom phenomenon and the effects of meteorological conditions on the magnitude are described. The government and nongovernment research and development programs are presented with the emphasis of the noise reduction studies on airplane and engine design, flight procedures, and reducing the impact of the noise on communities. F.O.S.

N71-10183# Air Force Academy, Colo. Frank J. Seiler Research Lab.
DETERMINATION OF REALISTIC PERFORMANCE TRADE-OFFS IN THE AIR-TO-AIR ROLE Final Report
Roger W. Gallington and David Finkleman Jul. 1970 15 p refs Presented at AIAA 2nd Aircraft Design and Operations Meeting, Los Angeles, 20 – 22 Jul. 1970 *Its* AIAA Paper No. 70-930
(AD-710497; SRL-69-0007) Avail: NTIS CSCL 15/7

Recent air superiority fighter studies have failed to include systematically the trade-offs between ordnance and aircraft capabilities. Compromises among performance demands must be

studied along with the capabilities of current technology in order to arrive at the most effective weapons system within the state-of-the-art. The investigation described has led to the formulation of a realistic design philosophy which allows analysis of the interrelated demands upon armament, detection capability, thrust, speed, and load factor. Author (TAB)

N71-10184# Naval Postgraduate School, Monterey, Calif.
A PILOT EVALUATION OF MOVABLE AND RIGID AIRCRAFT CONTROLS
James Daniel Cole (M.S. Thesis) Jun. 1970 82 p refs
(AD-709934) Avail: NTIS CSCL 1/3

A simulator facility employing a two-axis compensatory tracking task with a random-appearing signal was used to evaluate the performance of fifty-five pilot and non-pilot test subjects using four separate control sticks--two movable and two rigid. Pilot acceptance of the rigid cockpit controllers was determined by comparing individual pilot ratings of the sticks. Author (TAB)

N71-10279# Aerospace Corp., El Segundo, Calif. Air Transportation Program.
WESTERN REGION SHORT HAUL AIR TRANSPORTATION PROGRAM. VOLUME 1: DEMONSTRATION PROGRAM PLAN Definition Phase Report, Jul. 1970
E. R. Hinz Jul. 1970 132 p Sponsored in part by the Western Conf. of the Council of State Govt.
(ATR-71-(7190)-1-Vol-1) Avail: NTIS

The representative demonstration opportunities and requirements in the Western Region are described. Funding and management requirements to implement the program, study requirements associated with the implementation of specific demonstration activities, and the regulatory issues associated with the conduct of air transportation demonstrations are discussed. The technology bases and systems analyses are also included. Author

N71-10280# Aerospace Corp., El Segundo, Calif. Air Transportation Program.
WESTERN REGION SHORT HAUL AIR TRANSPORTATION PROGRAM. VOLUME 2: TECHNICAL REPORT Definition Phase Report, Jul. 1970
Jul. 1970 296 p refs Sponsored in part by the Western Conf. of the Council of State Govt.
(ATR-71-(7190)-1-Vol-2) Avail: NTIS

The technical and analytical base studies are discussed. The current state of the art and anticipated advances in aircraft, avionics, and ground systems are assessed, primarily from the standpoint of identifying available hardware appropriate for near-term demonstration applications. Advanced hardware concepts for the late 1970-1980 period and periodic addition of improved hardware are considered. Tradeoff analyses, competitive travel modes, equipment choices, and system operating economics are discussed. New analytical techniques were developed to assist in determining the potential viability of demonstration programs; notable is the transportation modal split program for determining traveler choice among competing modes of transport. Author

N71-10294# Bell Aerospace Co., Buffalo, N.Y.
SYSTEMS PERFORMANCE/DESIGN REQUIREMENTS SPECIFICATION FOR THE CH-46C HELICOPTER DIGITAL FLIGHT CONTROL AND LANDING SYSTEM
Apr. 1970 96 p refs
(Contract NAS12-2074)
(NASA-CR-110889; Rept-8200-933033) Avail: NTIS CSCL 01C

The performance, design, development, and test requirements for an experimental digital flight control and landing system (DFCLS) for the CH-46C helicopter were established. The DFCLS was used to demonstrate and evaluate flight control concepts under closely monitored flight test conditions and was not intended to be an operational system. Author

N71-10297# Bell Aerospace Co., Buffalo, N.Y.
DIGITAL FLIGHT CONTROL AND LANDING SYSTEM FOR THE CH-46C HELICOPTER Final Report
William Cockayne, Walter Rusnak, and Lionel Shub May 1970 135 p
(Contract NAS 12-2074)
(NASA-CR-111024; Rept-8200-933013) Avail: NTIS CSCL 01C

A set of control laws were defined for a digital approach and landing flight control subsystem. The flight control subsystem includes six manual modes with varying degrees of pilot assistance and a fully automatic mode. Guidance laws suitable for flight demonstration of the flight control system in an approach and landing under minimal visibility conditions were formulated. A real time simulation using a piloted cockpit was developed. The flight control and guidance laws were mechanized on an IBM 7090 computer in a manner similar to that in which they could be mechanized on an airborne computer. Performance criteria were established and automatic and pilot runs were made. A guidance and control configuration was established. Subsystem requirements and interfaces were defined to the device level. A system signal flow diagram was developed. Author

N71-10349# Washington Univ., Seattle.
EVALUATING THE NOISES OF TRANSPORTATION: PROCEEDINGS OF A SYMPOSIUM ON ACCEPTABILITY CRITERIA FOR TRANSPORTATION NOISE
James D. Chalupnik, ed. Apr. 1970 406 p refs Conf. held at Seattle, 26-28 Mar. 1969
(Contract DOT-OS-A9-036)
(PB-191-117; OST-ONA-70-2) Avail: NTIS

Conference papers are presented on noise sources and measurement, and individual and community responses. The major topics covered are aircraft, automobile, and truck noise; noise level measurement, effects, and evaluation; psychophysical studies, hearing damage, background noise effects, factors affecting judgement experiments, and effect of pop group music on hearing; measuring community responses to noise, noise complaints, and community action; predicting community responses, criteria for design and legislation, subjective response to community noise, origin and spread of public reaction to noise, and traffic noise investigation. N.E.N.

N71-10366# Federal Aviation Administration, Washington, D.C. Air Traffic Service.
TERMINAL AREA AIRLINES DELAY DATA, 1964 - 1969
Augusta Galbreath and Richard M. Warfield Sep. 1970 64 p refs
Avail: NTIS

Data are compiled on delays and cost of delays in terminal areas served by three airlines. The statistical data provide an indication of system effectiveness in the terminal environment. Basic data consist of the number of delays, minutes of delay, and cost of delay attributed to ATC, airport, and other causes during departure and arrival operations in terminal area. Delay costs are calculated by the reporting airlines and primarily represent direct operating costs. Author

N71-10372# Federal Aviation Administration, Washington, D.C.
FAA STATISTICAL HANDBOOK OF AVIATION
1969 287 p
Avail: SOD $2.75; NTIS

Data are presented on major civil aviation activities for the 11-year period ending 31 December 1969. The FAA, National Airspace System, civil and general aviation, airmen, aeronautical production, and accidents are covered. N.E.N.

N71-10386# Southampton Univ. (England). Inst. of Sound and Vibration Research.

THE RESPONSE OF, AND THE ACOUSTIC RADIATION FROM PANELS EXCITED BY TURBULENT BOUNDARY LAYERS Technical Report, 1 Dec. 1966 - 30 Nov. 1968

Edmond Szechenyi Wright-Patterson AFB, Ohio AFFDL Jun. 1970 186 p refs

(Contract F61052-67-C-0009)

(AD-710696; AFFDL-TR-70-94) Avail: NTIS CSCL 1/3

The principal aim of the work is to develop approximate solutions for both the response of skin-stringer panels to turbulent boundary layer excitation and the subsequently acoustic radiation from these structures. As a first step, the solution for the response of single simply supported panels is extended to include panels with clamped edges. Using this as the basic theory, solutions for the response of rows and arrays of skin-stringer panels are found by applying a method of effective or pseudo wavelengths. Equations for the radiation characteristics of single panels both with fixed and with simply supported edges are established from basic principles. These solutions are then used to find the radiation from arrays of bays by introducing a qualitatively derived system of relative bay phases. The combination of the radiation characteristics and of the response gives acoustic power radiation due to turbulent boundary layer excitation. This shows an interesting result which is probably particular to this form of excitation, that is, that for most practical configurations the acoustic power radiated by an array of bays does not exceed the arithmetic sum of the powers radiated separately by each bay. Author (TAB)

N71-10391*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MEASUREMENT AND ANALYSIS OF LIGHTNING INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL SYSTEMS

Paul T. Hacker and J. A. Plumer (GE, Pittsfield, Mass.) [1970] 28 p refs to be presented at the 1970 Lightning and Static Electricity Conf., San Diego, 9-11 Dec. 1970

(NASA-TM-X-52906) Avail: NTIS CSCL 01C

A series of measurements were made of voltages induced in electrical circuits within a metallic aircraft wing by full-scale simulated lightning currents flowing through its skin and structure. The measured data were mathematically analyzed to enable determination of voltages across load impedances to which the circuits might be connected elsewhere in the aircraft. Relationships between induced voltages and lightning current, wing structural, and circuit parameters were determined. Induced voltages of magnitudes likely to cause damage or interference with avionics were measured. Author

N71-10434# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

STRESSES AND DEFORMATIONS IN MULTI-PLY AIRCRAFT TIRES SUBJECT TO INFLATION PRESSURE LOADING Technical Report, Aug. 1968 - Dec. 1969

Howell K. Brewer Jun. 1970 209 p refs

(AD-711073; AFFDL-TR-70-62) Avail: NTIS CSCL 1/3

The pneumatic tire casing is treated as a laminated, anisotropic, toroidal shell of revolution possessing bending rigidity. The plies are considered to be homogeneous orthotropic laminae on a macroscopic scale, which are constructed of elastic textile cords embedded in an elastic rubber matrix. Modern micro-mechanics theory, which is based on the self-consistent model of composite materials, is used to calculate the four basic elastic moduli of a single lamina. The tire shell is considered to deform according to the classical Love hypothesis. The equilibrium, strain-displacement, and laminate constitutive equations governing the tire shell are reduced to a system of six first order ordinary differential equations with variable coefficients. A multi-segment, forward integration technique is used which first transforms the two point boundary value problem into an equivalent set of initial value problems which can then be integrated numerically with a fourth order Runge-Kutta routine. The finite displacements are taken into account by an incrementing process which builds up the total solution as sequence of linearized solutions. The theory and solution technique is illustrated by means of a numerical example. The tire chosen for this purpose is a 32 x 8.8 Type VII aircraft tire. A complete set of numerical data is presented. The calculations were verified experimentally by measuring tire strains and the inflated tire meridian profile. The agreement between theory and experiment is good. Author (TAB)

N71-10470# Air Vehicle Corp., San Diego, Calif.

A METHOD FOR CALCULATING HELICOPTER VORTEX PATHS AND WAKE VELOCITIES Final Report, Nov. 1968 - Dec. 1969

E. S. Levinsky and T. Strand Jul. 1970 72 p refs

(Contract F33615-69-C-1101)

(AD-710694; AFFDL-TR-69-113) Avail: NTIS CSCL 1/3

A simple method is developed for calculating the time averaged velocity field induced at large distances from the rotor by a helicopter in steady horizontal motion. The influence of the ground plane and of horizontal winds on the rotor wake and velocity field is included. Author (TAB)

N71-10495*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF A JET TRANSPORT AIRPLANE CONFIGURATION WITH HIGH THRUST-WEIGHT RATIO AND AN EXTERNAL-FLOW JET FLAP

Lysle P. Parlett, Delma C. Freeman, Jr., and Charles C. Smith, Jr. Washington Nov. 1970 75 p refs

(NASA-TN-D-6058; L-7166) Avail: NTIS CSCL 01A

An investigation was conducted in a full-scale tunnel to determine the aerodynamic, stability, and control characteristics of a jet transport configuration that has a high thrust-weight ratio and is equipped with an external-flow jet flap. The model is powered by four high-bypass-ratio turbofan engines. Maximum lift coefficients of about 8 were measured for test conditions which simulated a jet transport configuration having a thrust-weight ratio of about 0.5. Longitudinal instability was encountered at high thrust coefficients because of adverse downwash variations in the vicinity of the tail. This problem was solved by raising the tail and moving it forward to a more favorable downwash field. The model was laterally and directionally stable under all power conditions. The moments associated with an engine failure were too large to be trimmed out by conventional aileron and rudder control; spoilers alone provided enough control to offset the engine-out rolling moments but the lift loss associated with the use of spoilers was severe. Author

N71-10531# National Transportation Safety Board, Washington, D.C.

AIR FRANCE BOEING 747-128, F-BPVD SAINT JEAN PQ, CANADA, AUGUST 17, 1970: AIRCRAFT INCIDENT REPORT

7 Oct. 1970 14 p

(NTSB-AAR-70-26) Avail: NTIS

The flight from Chicago to Montreal was normal in every respect. The takeoff from Montreal at 2226 was routine; however, approximately 9 minutes after takoff, at 2235 at an altitude of 5,600 feet m.s.l., a separation of the second-stage turbine disk rim of the No. 3 engine occurred, and pieces penetrated and ruptured the high-pressure turbine case and associated engine cowling. The separation of the turbine disk rim resulted in a localized fire in the upper forward portions of No. 3 engine. A fire warning, which came on simultaneously with the turbine failure, terminated after both containers of fire extinguishing agent were discharged. The No. 3 engine was shut down and the flight diverted to John F. Kennedy International Airport, New York, where it landed safely at 0004 (August 18). There were no injuries to passengers, crew, or

persons on the ground. The Board determined that the probable cause of this incident was the in-flight separation of the second-stage turbine disk rim of the No. 3 engine. The separation of the disk rim was the result of incorrect assembly of the high-pressure turbine module. Author

N71-10563# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF THE LONGITUDINAL STATIC STABILITY OF THE US-2A AIRCRAFT
Paul William Cooper, Jr. (M.S. Thesis) Apr. 1970 63 p refs
(AD-710722) Avail: NTIS CSCL 1/3

The aircraft was equipped with a data acquisition system capable of sensing and recording aerodynamic data other than that given by the standard cockpit instruments. Recorded data were displayed graphically and the neutral points for stick-free stability and stick-fixed stability were determined. Stick-free static margin and stick-fixed static margin were determined and evaluated. Author (TAB)

N71-10564# Army Electronics Command, Fort Monmouth, N.J. Avionics Lab.
A METHOD FOR DETERMINING A CONCEPTUAL SOLUTION TO ENSURE 301
R. Joseph Milelli, John F. O'Connor Jun. 1970 25 p
(AD-710948; ECOM-3302) Avail: NTIS CSCL 1/3

A requirement (ENSURE 301) exists for a system which will enable a pilot to hover in the CH-54 with reasonable precision (undefined) over a predetermined point for 10 minutes or less in IFR conditions while personnel on the ground attach or remove cargo from a sling load. Several schemes have been proposed by airframe and electronics contractors, including different control systems, displays, and sensors. The Government is required to evaluate the various proposals and the purpose of the paper is to illustrate how using a simulation in the evaluation can suggest a conceptual solution. Author (TAB)

N71-10674# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
STUDY OF AIR TAXI ACCIDENTS: A STATISTICAL SUMMARY AND ANALYSIS OF A SPECIAL SEGMENT OF US GENERAL AVIATION, 1964-1968
May 1970 190 p refs
(NTSB-AAS-70-1) Avail: NTIS

This study was compiled from the records of 995 accidents occurring in Air Taxi flying during the 5-year period 1964-68. Collisions between aircraft are treated as one accident. A complete analysis and coding is done on each aircraft involved in collisions. This produces two aircraft accident records, one for each aircraft involved in the collision. Consequently, when compiling information on accidents including collisions between aircraft, the number of accident records will exceed the number of accidents. All analytic tables show both records and accidents. Author

N71-10734# Dayton Univ., Ohio. Research Inst.
PARAMETRIC STUDY OF NATURAL FREQUENCIES OF SKIN-STRINGER STRUCTURE
T. J. McDaniel Wright-Patterson AFB, Ohio AFML Jul. 1970 90 p refs
(Contract F33615-67-C-1187)
(AD-711383; AFML-70-145) Avail: NTIS CSCL 1/3

The results of a parametric study of the natural frequencies of a row of skin-stringer structures are contained in this report. Typical aircraft structures with hat-section, Z-section, or milled stringers were considered. The effect on the natural frequencies of parametric variation of stringer spacing, distance between frames, thickness of the covering skin, and material properties of the structure are tabulated. These results were obtained from a delta-matrix procedure which is developed from a transfer matrix analysis of the skin-stringer structure. Improvements in the transfer matrix analysis of the structure are also developed. Author (TAB)

N71-10812# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: THE PITTSON COMPANY AERO COMMANDER 1121, N236JP, RURAL RETREAT, VIRGINIA, 31 OCTOBER 1969
9 Sep. 1970 20 p *Its* File No. 3-4110
(NTSB-AAR-70-22) Avail: NTIS

The Aero Commander 1121 crashed while descending on a radar vector to the final approach course at Tri-City. The crew of two and the one passenger aboard the aircraft were fatally injured. The aircraft made contact with the ground 2,450 feet above sea level while in approximately 60 deg nosedown wings-level attitude. The impact site was about 2 miles northeast of Mountain Empire Airport, Rural Retreat, Virginia. The probable cause of this accident was that, following a malfunction or failure in the 115-volt alternating current electrical system, the crew did not take proper action, resulting in the loss of the pilot's flight instruments in instrument flight conditions and subsequent loss of control. Author

N71-10813# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: MACK TRUCK, INCORPORATED LEAR JET 23A, N1021B, HORLICK-RACINE AIRPORT, RACINE, WISCONSIN, 6 NOVEMBER 1969
9 Sep. 1970 17 p *Its* File No. 3-3766
(NTSB-AAR-70-21) Avail: NTIS

Lear Jet N1021B, crashed into Lake Michigan while executing an instrument approach to Runway 22 at the Horlock-Racine Airport, Racine, Wisconsin. There were seven people aboard the aircraft; the pilot, copilot, and five passengers, none of whom have been found to date. Radar contact was lost shortly after the flight was advised that it was passing a radar fix 3.6 nautical miles northeast of the radio beacon which is located on the southern boundary of the airport. It is determined that the probable cause of this accident was the continued descent below the prescribed approach path profile, for reasons unknown. Author

N71-10814# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT INCIDENT REPORT: BOEING 747, N732PA, RENTON AIRPORT, RENTON, WASHINGTON, 13 DECEMBER 1969
26 Aug. 1970 30 p *Its* File No. 5-0046
(NTSB-AAR-70-19) Avail: NTIS

The probable cause of this incident was the premature touchdown of the aircraft during a visual approach to a relatively short runway, induced by the pilot's not establishing a glidepath which would assure runway threshold passage with an adequate safety margin, under somewhat unusual environmental and psychological conditions. During an approach to a landing at Renton, the Boeing 747 aircraft struck an embankment approximately 20 feet short of the threshold of Runway 15. The ground contact point was approximately 30 inches below the top of the bank and the runway level. The aircraft came to a stop on the centerline of Runway 15, approximately 3,500 feet beyond the threshold. Small fires broke out in the No. 3 engine wing strut and the No. 4 engine forward of the tail cone. These were immediately extinguished. Structural damage was confined to the right wing landing gear, right flap assemblies, and the Nos. 3 and 4 engines and their cowlings. Author

N71-10815# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: OZARK AIR LINES, IN-

CORPORATED, DOUGLAS DC-9-15, N974Z, SIOUX CITY AIRPORT, SIOUX CITY, IOWA, 27 DECEMBER 1968
2 Sep. 1970 42 p *Its* File No. 1-0039
(NTSB-AAR-70-20) Avail: NTIS

A Douglas DC-9 crashed while taking off from the Sioux City Airport, Sioux City, Iowa. There were no fatalities. The probable cause of this accident was a stall near the upper limits of ground effect, with subsequent loss of control as a result of the aerodynamic and weight penalties of airfoil icing. The flightcrew failed to have the airfoil ice removed prior to the attempted takeoff and selected an improper takeoff thrust for the existing gross weight conditions of the aircraft. Author

N71-10914# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: UNITED AIR LINES, INCORPORATED, BOEING 727-22C, N7434U NEAR LOS ANGELES, CALIFORNIA, 18 JANUARY 1969
18 Mar. 1970 44 p
(PB-190812; NTSA-AAR-70-6) Avail: NTIS CSCL 01B

The report contains the analysis, findings and recommendations made by the National Transportation Safety Board and applicable to a Boeing 727's crash while the crew attempted to abort a take-off. USGRDR

N71-10932# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS, 1969, NO. 2: US CIVIL AVIATION
Feb. 1970 456 p
(PB-190792; NTSB-BA-70-2) Avail: NTIS CSCL 01B

The publication contains reports of U. S. civil aircraft accidents. The reports are reproduced directly from the coded record on magnetic tape. The cause factor, accident types, operational phases, and kinds of flying are tabulated. Author (USGRDR)

N71-10933# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS, 1968, NO. 7: US CIVIL AVIATION
Feb. 1970 197 p
(PB-190811; NTSA-BA-70-1) Avail: NTIS CSCL 01B

The publication contains reports of U.S. Civil aircraft accidents. The reports are reproduced directly from the coded record on magnetic tape. The cause factor, accident types, operational phases, and kinds of flying are tabulated. Author (USGRDR)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-10059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE CHARACTERISTICS OF A VOLTAGE REGULATOR AND A PARASITIC SPEED CONTROLLER ON A 14.3-KILOVOLT-AMPERE, 1200-HERTZ MODIFIED LUNDELL ALTERNATOR
Bill O. Ingle, Heinz L. Wimmer, and Richard C. Bainbridge
Washington Nov. 1970 30 p refs
(NASA-TN-D-5924; E-5642) Avail: NTIS CSCL 09E

The prototype control components of a 10-kW, 1200-Hz Brayton electrical subsystem were tested utilizing a prototype Brayton alternator. The tests were performed to obtain preliminary data prior to the operation of the integrated Brayton system. The control components consist of an electronic voltage regulator and a parasitic-loading speed controller. The steady-state results of the test program are presented. These results verify the capability of the electrical components to deliver full rated load at the desired levels of voltage and frequency. Author

N71-10258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT POWER: GUIDANCE AND CONTROL DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 60-71 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 10B

Research progress is reported on analytical calculation of the neutron yield from (alpha, n) reactions of low-Z impurities, the design of a thick-film microcircuit dc-to-dc converter, electrochemical cells incorporating liquid amalgam electrodes, and development of heat-sterilizable nickel-cadmium batteries for spacecraft power supplies. R.B.

N71-10261*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATERIALS: ENGINEERING MECHANICS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 79-87 (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 10B

Materials technology and fabrication processes for optimizing the performance characteristics of multilayer insulation thermal shield systems for use on spacecraft are discussed. A feasibility study was conducted on the problems of interconnecting solar cells and mounting them on a structural panel to reduce fabrication costs. Thick-film ink technology, a printed circuit interconnection scheme, and wraparound cell contacts to allow simultaneous interconnection and structural mounting of the cells were considered as the basic approach. R.B.

N71-10436# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
THIN FILM CDS SOLAR CELL FABRICATION PARAMETER STUDY Interim Technical Report
T. F. Deucher Jun. 1970 18 p
(Contract F33615-68-C-1182)
(AD-710636; ARL-70-0099) Avail: NTIS CSCL 10/2

The study is, essentially, a brief description of the processes, currently used and alternatives, necessary to the manufacture of thin film CdS solar cells. These processes relate to the application of the conductive layer to the plastic film, plating on of a suitable metallic interlayer, deposition of the CdS layer, formation of the barrier, attachment of the conductive grid and cover plastic and in process and final testing. Material costs and productivity of each of the present manufacturing processes are listed, and as a comparison, material costs and productivity based on high production methods are estimated wherever possible. Those processes or operations which lend themselves presently to large volume production have been incorporated into suggested mechanisms that are briefly described. A few, of which gridding is an example, are in need of further study, as to processes which are more adaptable to mechanization than at present. Author (TAB)

N71-10490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL WINDAGE LOSSES FOR A LUNDELL GENERATOR OPERATING IN AIR IN THE TURBULENT FLOW REGIME
Sol H. Gorland and Erwin E. Kempke, Jr. Oct. 1970 12 p refs
(NASA-TM-X-52905) Avail: NTIS CSCL 10B

Viscous torque (windage) of a Lundell-type rotor having a major diameter of 8 inches and rotating within a concentric housing was measured at speeds up to 36,000 rpm. Radial air gaps

of 0.039 and 0.080 inch, corresponding to gap-to-radius ratios of 0.01 and 0.02, were tested. The 8-inch diameter cylindrical section of the housing was tested with a smooth inner surface and with an inner surface having axial slots to simulate the winding slots in an actual alternator. In the turbulent-flow regime, power loss for a slotted housing is 30 to 40 percent higher than for a smooth housing. Pressure rise due to the pumping effect of the conical sections was measured; this pressure rise can be calculated using equations for enclosed rotating discs. Author

N71-10517# Mallory (P.R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
LONG SHELF LIFE ORGANIC ELECTROLYTE BATTERY Quarterly Report, 21 Mar. - 19 Jun. 1970
A. N. Dey and L. F. Athearn Aug. 1970 83 p
(Contract DAAB07-70-C-0076)
(AD-711114; ECOM-0076-2; QR-2) Avail: NTIS CSCL 10/3

The fabrication of organic electrolyte cells having a wide operating temperature range and high energy density is described. Preliminary testing of small scale cells was completed. Procurement of all tooling and special equipment was completed. Author (TAB)

N71-10585*# National Aeronautics and Space Administration, Washington, D.C.
AMERICA IN SPACE, THE FIRST DECADE: SPACECRAFT POWER
William R. Corliss [1969] 22 p ref
(NASA-EP-59) Avail: SOD $0.35; NTIS CSCL 10B

Operating parameters of spacecraft power supply systems are reviewed. Energy sources discussed include batteries, fuel cells, solar cells, radioisotope thermoelectric generators, and nuclear fission power plants. E.C.

N71-10606* General Electric Co., Philadelphia, Pa.
DIDYMIUM HYDRATE ADDITIVE TO NICKEL HYDROXIDE ELECTRODES Patent
William N. Carson, Jr., inventor (to NASA) Issued 28 Mar. 1967 (Filed 19 Oct. 1965) 3 p Cl. 136-28 Sponsored by NASA
(NASA-Case-XGS-03505; US-Patent-3,311,502; US-Patent-Appl-SN-498167) Avail: US Patent Office CSCL 10C

A method is described for including didymium hydrate in the nickel hydroxide of the positive electrode of storage batteries. The presence of didymium doubles the ampere hour capacity of the nickel hydroxide electrode and reduces the weight of nickel hydroxide by half required for a given capacity. Two examples of preparing the didymium hydrate are given. R.B.

N71-10665*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
ATS SPACECRAFT POWER SYSTEM CONFIGURATION STUDY Final Report, 1 Jan. - 31 Aug. 1970
Sep. 1970 179 p
(Contract NAS5-21123)
(NASA-CR-111140; SSD-00428) Avail: NTIS CSCL 10B

Presented are data which will aid in the optimization of regulation and conversion of spacecraft electrical power. The study is based on applications technology satellite mission requirements and power system designs. The ATS power systems use a decentralized bus with remotely located regulators and converters. A detailed analysis and discussion of the existing systems is provided with unit level data tabulations of size, weight, parts count, efficiency, reliability, and electrical performance. Three competing centralized systems are designed to provide equivalent electrical performances. Similar details of these designs are tabulated for comparison with the present decentralized design. The major changes occur when comparing a centralized DC regulator design to the present decentralized design. Adding a centralized converter to the DC centralized regulation system had negligible additional impact. Use of a centralized AC distribution system is shown to be heavier and less efficient than other centralized systems. The study concludes with an examination and tabulated discussion of all factors which have a bearing on the power system design and centralization decision. Author

N71-10715# Army Electronics Command, Fort Monmouth, N.J.
ENGINEERING EVALUATION OF LOW TEMPERATURE HIGH RATE RESERVE MAGNESIUM PERCHLORATE BATTERIES
Achille L. Almerini and Carl A. Nordell Jul. 1970 28 p
(AD-710952; ECOM-3307) Avail: NTIS CSCL 10/2

An engineering evaluation program successfully demonstrated the feasibility of magnesium perchlorate electrolyte batteries in meeting high rate and low temperature requirements of telemetry systems in Army warheads. More effort is needed, however, to achieve a single battery design and electrolyte formulation that will work over the entire temperature range of -40F to +140F. While both manganese dioxide or mercuric oxide batteries were satisfactory, the former show more favorable voltage characteristics. Further design work is recommended to achieve optimum cell and battery construction features and to optimize such critical factors as electrolyte formulation, volume and methods for fast and uniform activation. Author (TAB)

N71-10728* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD FOR DETERMINING THE STATE OF CHARGE OF BATTERIES BY THE USE OF TRACERS Patent
George M. Arcand, inventor (to NASA) Issued 2 May 1967 (Filed 5 Feb. 1965) 4 p Cl. 136-182 Sponsored by NASA
(NASA-Case-XNP-01484; US-Patent-3,317,352; US-Patent-Appl-SN-430778) Avail: US Patent Office CSCL 10C

A method for determining the state of charge of alkali batteries by the use of tritium as a tracer is described. During discharge of the alkali battery some of the tritium in the electrolyte is deposited on the electrodes. By using a scintillation counter the undeposited tritium in the electrolyte is determined with the state of charge. The nickel-cadmium battery is used to illustrate the method. F.O.S.

N71-10845# Army Electronics Command, Fort Monmouth, N.J.
STANDARD FAMILY OF POWER SOURCES
David Linden and Louis J. Pilla Jul. 1970 31 p refs
(AD-710951; ECOM-3306) Avail: NTIS CSCL 10/3

A standard family of power sources is proposed which will minimize the number and variety of power sources, prevent the flooding of the supply system with hardware that only could be used in a single application and provide the user with a family of power sources from which he could select one suitable to meet the needs of his equipment. This standard family incorporates the use of standard output voltages (6/12/24 volts), a standard connector which provides electric interchangeability and standard dimensions which provide physical interchangeability. The use of the standard family achieves a new concept in the deployment of power sources. No longer is a single power source developed for each equipment; rather, the selection of a battery is based on the mission requirement. A list of power sources, including batteries, fuel cells, thermal energy generators, and power supplies being developed as part of the standard family, is included in the report. Author (TAB)

N71-10838# Army Electronics Command, Fort Monmouth, N.J. Power Sources Div.
FEASIBILITY STUDY OF THE LITHIUM/C(x)F PRIMARY CELL Technical Report, Oct. 1968 - May 1970
Klaus Braeuer Aug. 1970 81 p refs
(AD-711521; ECOM-3322) Avail: NTIS CSCL 10/3

A graphite-fluorine intercalation compound, C(x)F, has been proposed as a cathode material for an organic electrolyte primary cell

to achieve, simultaneously, high energy density during operation and long shelf-life during storage in the activated state. This investigation was carried out to determine if the concept of a lithium/C(x)F-cell is feasible by studying the chemical and electrochemical reactions of C(x)F in various organic electrolyte solutions. C(x)F was synthesized by fluorination of graphite and the crude compound treated in several different ways to remove volatile or soluble impurities. Samples of C(x)F were brought into equilibrium with the electrolytes and the amounts of H(+), Fe(3+) and F(-) generated by non-electrochemical processes analytically determined. Porous C(x)F electrodes were prepared. The open circuit potentials, steady-state potentials, operating voltages, currents, and ampere-hours of C(x)F-cathodes and Li/C(x)F-cells were measured during discharge under galvanostatic and potentiostatic conditions. Reaction products were qualitatively determined in cathode mixes by X-ray diffraction analysis. The capacity, cell voltage, energy density, rate capability, shelf life and cost of Li/C(x)F-cells have been compared with those of other lithium systems in order to arrive at a meaningful conclusion about the feasibility of the Li/C(x)F-primary cell. A manufacturing process for C(x)F was outlined and the cost of this compound estimated. Author (TAB)

N71-10963*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALOG COMPUTER SIMULATION OF A PARASITICALLY LOADED ROTATING ELECTRICAL POWER GENERATING SYSTEM

Leonard J. Gilbert Washington Nov. 1970 25 p refs

(NASA-TN-D-6070; E-5616) Avail: NTIS CSCL 10B

An analog computer simulation of a parasitically loaded rotating electrical power generating system was developed to facilitate study of the dynamic performance of the system. System equations are expressed in terms of direct and quadrature axis variables in order to simplify the analysis. Identity of the system components is retained in the simulation so that component parameters can be readily varied and the effects observed. The simulation is applicable to the analytical study of paralleled systems. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-10034# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMBINED EFFECTS OF NOISE AND VIBRATION ON PSYCHOMOTOR PERFORMANCE Final Report, May - Sep. 1969

C. Stanley Harris and Richard W. Shoenberger May 1970 29 p refs

(AD-710595; AMRL-TR-70-14) Avail: NTIS CSCL 6/19

Tracking performance and reaction time to the appearance of a light (red lights) and disappearance of a light (green lights) of highly trained subjects were measured during four experimental conditions. There were two conditions of 85 dB and 110 dB broadband noise exposure, and two conditions in which these noise exposures were combined with 0.25G vertical vibration at 5 Hz. Duration of exposure for each condition was 19 minutes. Vibration was found to have an adverse effect on both the horizontal and vertical dimensions of the tracking task and on reaction time to both sets of lights. Noise had a significant effect, both with and without vibration, but only on the vertical part of the tracking task. On vertical tracking, the detrimental effect of noise was additive to that of vibration when both noise and vibration were presented simultaneously (110dB noise and 0.25G vertical vibration at 5 Hz). Author (TAB)

N71-10124# Rutgers Univ., New Brunswick, N.J. Center for Transportation Studies.

COMPARISON OF AIR POLLUTION FROM AIRCRAFT AND AUTOMOBILES. PROJECT EAGLE Final Report

Cooper Bright, Toivo Lamminen, James Mullaly, Forest Markowitz, and Stanford M. Singer Sep. 1970 174 p refs

(Contract FAA-W1-70-1919-1)

(FAA-NO-70-14) Avail: NTIS

The investigation into the environmental aspects of establishing an urban air transportation system for the tri-state area of Connecticut, New Jersey, and New York for daily commuting demonstrates that air pollution and its associated physiological effects, which are created by automobile engine emissions, can be drastically reduced. Similar results pertain when STOL air transportation is substituted for automobiles to provide service for the same area to the three major airports around New York City. The study shows that air pollution at a STOLport in Manhattan supporting such a system would be less than the normal background concentration, even during peak travel periods. Author

N71-10125*# National Aeronautics and Space Administration, Washington, D.C.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES

Sep. 1970 151 p refs

(NASA-SP-7011(80)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N71-10175# Advisory Group for Aerospace Research and Development, Paris (France).

PHYSIOPATHOLOGY AND PATHOLOGY OF AFFECTIONS OF THE SPINE IN AEROSPACE MEDICINE

Roland-Paul Delahaye, Roger Pannier, Henry Seris, Robert Auffret, Raymond Carre et al Aug. 1970 83 p refs

(AGARD-AG-140-70) Avail: NTIS

A review is presented on the aitiology, diagnosis, and prognosis of spinal injuries where these are associated with aviation (in rotary or fixed wing aircraft, in parachuting or gliding). Emphasis is placed on methods of prophylaxis. The opening shocks of static line parachuting are compared where two packing methods are employed. The adoption of various sitting positions in a pilot's seat, particularly in regard to method of bracing immediately before ejection or before crash landing, is discussed. The importance of keeping a radiographic record of the individual's spine for subsequent comparison should he be involved in an accident resulting in spinal injury is stressed. Author

N71-10177# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMPARATIVE EFFECTS OF AUDITORY AND EXTRA-AUDITORY ACOUSTIC STIMULATION ON HUMAN EQUILIBRIUM AND MOTOR PERFORMANCE Final Report, Jul.-Dec. 1968

Henry C. Sommer and C. Stanley Harris Jun. 1970 21 p refs

(AD-711046; AMRL-TR-70-26) Avail: NTIS CSCL 5/10

Human equilibrium and psychomotor performance of subjects exposed to free-field broadband noise was compared to that for subjects exposed to similar spectra of noise presented through earphones. The major difference between exposures was the extra-auditory acoustic stimulation received by the free-field exposure

groups. In the present experiment, the performance of subjects was tested during three different conditions of noise exposure. The noise spectra and levels presented through earphones approximated those delivered to the ear canals of subjects wearing ear protectors in a free-field broadband noise of 140 dB. The types of ear protectors used to create the noise conditions in the preceding experiments and the corresponding intensity levels of the present experiment were earplugs and muffs (100 dB overall SPL in each earphone), earplugs (115 dB overall SPL in each earphone), and earplugs with one earmuff covering only the right ear (115 dB in the left earphone and 100 dB in the right earphone). Author (TAB)

N71-10245# Universidad Peruana de Ciencias Medicas y Biologicas, Lima (Peru). Inst. de Investigaciones de La Altura.
PHYSIOLOGY OF RESPIRATION OF HIGH ELEVATIONS Annual Report, 1 Aug. 1969 - 31 Jul. 1970
Julio C. Cruz-Jibaja Jul. 1970 12 p refs
(Contract DAHC19-70-G-0003)
(AD-710327; AR-2) Avail: NTIS CSCL 6/19

A hypoxic isocapnic test was used to study 40 sea level (SL) subjects. The data suggest that a high elevation environment produces a sensitization of the peripheral chemorreceptors in SL subjects. The lower the response at SL the higher the response at HA. The possibility of using the hypoxic isocapnic test as a tool of predicting the degree of adaptation to altitude is discussed. TAB

N71-10248# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PERCEPTION OF ULTRALOW FREQUENCY SINUSOIDAL PROPRIOCEPTIVE STIMULI
Richard W. Shoenberger, C. Stanley Harris, and Henning E. Von Gierke Jun. 1970 14 p refs
(AD-711045; AMRL-TR-69-81) Avail: NTIS CSCL 6/16

Subjects judged change of direction of a sinusoidally oscillating table during exposure to seven frequencies within the range of 0.0125 to 0.8 Hz. Phase differences were computed by taking the difference between subjective judgment of change of direction and the actual change of direction of the table. These phase angles were obtained during four experimental conditions. Two conditions in which the subjects sat on the oscillating table with braces applied either to the hips or shoulders so that total body movement was constrained. And two conditions in which only the leg rested on the oscillating platform. The phase angles obtained at these conditions were compared with those obtained by previous investigators from subjects who experienced whole body displacement, that is, they received a vestibular stimulus in addition to stimulation of the skin, muscles, and joints as occurred in the present study. The pattern of phase angles between experiments was sufficiently different to cast doubt on the hypothesis that receptors of the skin, muscles, and joints accounted for the results in the prior experiment. Author (TAB)

N71-10269*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SYSTEMS ANALYSIS: MISSION ANALYSIS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 170-172 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 05J

Several individual preference patterns were combined into a single preference pattern for the society composed of those individuals. In combining orderings from several sources into a single ordering that represents a consensus, numerical techniques try to produce results that contain more information than is present in the input. It is suggested that if the statement, 'The data do not specify the consensual relationship between certain objects,' is admitted, it is possible to present a consensus that contains no more and no less information than can be inferred from the partial orderings. R.B.

N71-10274# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
STUDIES ON THE STORAGE STABILITY OF HUMAN BLOOD CHOLINESTERASES. 1
Charles R. Crane, Donald C. Sanders, and John K. Abbott Jan. 1970 11 p refs
(AM-70-4) Avail: NTIS

Whole blood, red cell, and plasma preparations were stored at room temperature, refrigerated, and frozen. Samples were assayed over a 50-day period using the technique of constant-pH titration (pH-Stat). At least 90% of the cholinesterase activity in the whole blood and plasma preparations was retained for 6 days at room temperature and over 6 weeks when refrigerated or frozen. Red cell preparations retained 90% activity for less than 12 hours at room temperature, for up to 3 days if refrigerated, and up to 6 weeks when frozen. Author

N71-10293# Human Engineering Labs., Aberdeen Proving Ground, Md.
EFFECTS OF THE THERMAL STRESS ON HUMAN PERFORMANCE: A REVIEW AND CRITIQUE OF EXISTING METHODOLOGY
R. Douglas Jones May 1970 78 p refs
(AD-711012; HEL-TM-11-70) Avail: NTIS CSCL 5/10

A critical review of the literature provides the basis for an analysis of the effects of thermal stress on human performance. Research in this area to date reflects a wide divergence of opinion regarding the magnitude, direction and significance of performance changes occurring under conditions of high temperature, humidity, solar radiation, etc. An attempt to resolve major conflicts in experimental findings leads to a detailed examination of such factors as thermal stress indices, exposure times and acclimatization. The role of the subject in thermal stress research is discussed with emphasis on the contribution of such psychological variables as personality and motivation to performance change. Recommendations for future research are advanced. Author (TAB)

N71-10298# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
INDEX TO FAA OFFICE OF AVIATION MEDICINE REPORTS, 1961-1969
Sep. 1970 18 p
(AM-70-1) Avail: NTIS

An index to Office of Aviation Medicine Reports (1964-69) and Civil Aeromedical Research Institute Reports (1961-63) is presented as a quick reference for those engaged in aviation medicine and related activities. It provides a listing of all FAA aviation medicine reports published from 1961 through 1969 by year, number, author, subject, and title. Author

N71-10341*# Techtran Corp., Glen Burnie, Md.
MORPHOLOGICAL AND CYTOLOGICAL ASPECTS OF THE STUDY OF HYPOKINESIA
V. V. Portugalov et al. Washington NASA Nov. 1970 13 p refs Transl. into ENGLISH from the Russian Presented at the 21st Intern. Astron. Congr., Constance, West Ger., 13 p Oct. 1970
(Contract NASw-2037)
(NASA-TT-F-13376) Avail: NTIS CSCL 06S

Histological, histochemical, electron microscopical and biometrical techniques were used to examine the state of antigravity muscles of rats exposed to hypokinetic conditions for 1 to 60 days. Changes occurred in the skeletal muscles at very early stages of the experiment, being most pronounced in the red slow soleus muscle. Of interest was the formation of the so called target fibers and fibers with central core disease that did not develop in the mixed fast--quadriceps and gastrocnemius--muscles. It was demonstrated biometrically that at the beginning of the experiment soleus fibers

showed hypertrophic changes and only 30 days later they displayed strophic changes. Red and white fibers of mixed fast muscles displayed progressive atrophy that was detected from the 15th day of the experiment. Hypokinetic conditions produced not only direct effects on the structure and metabolism of skeletal muscle but also side effects closely associated with the fixation method used. Author

N71-10357*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF EUGLOBULIN LYSIS TIME WITH THE LYSOGRAPH [DIE BESTIMMUNG DER EUGLOBULIN-LYSEZEIT MIT DEM LYSOGRAPHEN]
E.Kuhnke et al Washington NASA Nov. 1970 5 p refs Transl. into ENGLISH from Thromb. Diath. Haemorrhag. (Stuttgart), v. 9, 1963 p 475–478
(Contract NASw-2038)
(NASA-TT-F-13389) Avail: NTIS CSCL 06E

Photometric measurements of euglobulin lysis times and their recording by direct printer are reported. The preparation of the euglobulin for lysography is described, and the lysogram is analyzed. F.O.S.

N71-10367*# Translation Consultants, Ltd., Arlington, Va.
PECULIARITIES OF THE HUMAN HEAT EXCHANGE UNDER REDUCED ATMOSPHERE PRESSURE AND SUFFICIENT OXYGEN SUPPLY [OSOBENNOSTI TEPLOOBMENA CHELOVEKA V USLOVIYAKH PONIZHENNOGO BAROMETRICHESKOGO DAVLENIYA PRI DOSTATOCHNOM KISLORODNOM OBESPECHENII]
Ye M. Kuz'micheva et al Washington NASA Oct. 1970 11 p refs Transl. into ENGLISH from the Russian Presented at the 21st Intern. Aeron. Congr., Constance, West Ger., 4–10 Oct. 1970
(Contract NASw-2038)
(NASA-TT-F-13374) Avail: NTIS CSCL 06P

The heat balance in man under normal conditions and reduced atmospheric pressure was studied by comparing the body heat production with the heat transfer through convection, radiation and evaporation. The results of the experiments conducted show the extent of decreasing convection heat loss as well as the increasing heat transfer through evaporation in man under the rarified atmosphere (0.42 and 0.27 kg/sq cm) and air temperature of 25 C. Author

N71-10368*# Translation Consultants, Ltd., Arlington, Va.
HOMEOSTASIS DURING WEIGHTLESSNESS [GOMEOSTAZ V USLOVIYAKH NEVESOMOSTI]
B. B. Yegorov Washington NASA Nov. 1970 12 p Transl. into ENGLISH from the Russian Presented at the 21st Intern. Astron. Congr., Constance, West Ger., 4-10 Oct. 1970
(Contract NASw-2038)
(NASA-TT-F-13373) Avail: NTIS CSCL 06S

A model was developed to show changes that occur during weightlessness when there is inadequate afferentation from the muscle proprioceptors. Effects from the interoceptors are also taken into account. Weightlessness-induced changes in blood circulation regulation and hydrostatic impairments in the body are examined. Transition from acceleration to weightlessness can cause a marked blood redistribution in the body including intensified diuresis and natriuresis; the latter are considered in detail. It is shown that water balance is determined by the relationship among suprarenal hormones, ADH, Na, Cl, K, and other elements, the volume of extracellular fluid, cardiac minute volume, and state of catalytic enzymes. The marked imbalance between the level of circulating blood required for ensuring metabolic processes and the mass of circulating blood stable during weightlessness causes periodic regularly alternating manifestations of polyuria and water retention. This is accompanied by impairment of the body electrolyte balance. Author

N71-10369*# Translation Consultants, Ltd., Arlington, Va.
RESULTS OF BIOLOGICAL STUDIES PERFORMED ABOARD THE ZOND-5, 6, 7 STATIONS [REZUL'TATY BIOLOGICHESKIKH ISSLEDOVANIY, VYPOLNENNYKH NA STANTSIYAKH ZOND-5-6-7]
O. G. Gazenko et al Washington NASA Nov. 1970 19 p refs Transl. into ENGLISH from the Russian Presented at the 21st Intern. Astron. Congr., Constance, West Ger., 4-10 Oct. 1970
(Contract NASw-2038)
(NASA-TT-F-13372) Avail: NTIS CSCL 06C

These stations carried tortoises, Drosophila, Tradescantia, common onion bulbs, dry seeds of wheat, barley, etc., different strains of Chlorella, enteric bacilli, and other objects. Physiological, morphological, histochemical, genetic, and other methods were used to study possible effects. Details are given for each biological object used in the experiment. It was found that flight conditions on these three vehicles did cause definite shifts in the physiological functions and hereditary structures of some objects but both qualitatively and quantitatively these changes did not suffer from the shifts observed in experiments made in orbits below the radiation belts. Accordingly, radiation conditions on the investigated earth-moon-earth trajectory are not dangerous for manned flight provided that solar activity is at a low level. Author

N71-10374*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIOLOGICAL MONITORING OF THE CAPSULE MECHANICAL TRAINING MODEL DURING ASSEMBLY IN THE STERILIZATION ASSEMBLY DEVELOPMENT LABORATORY
D. M. Taylor and G. H. Redmann 25 Aug. 1969 22 p refs Sponsored by NASA
(NASA-CR-111093; JPL-611-7) Avail: NTIS CSCL 06M

Low microbial burden assembly procedures were developed using a rigorous monitoring program capable of providing estimates of the microbiological burden on the hardware during assembly. The resulting data provided a basis for the selection of optimum assembly processes and the design and operation of support facilities. The biological monitoring plan for the hardware assembly integrated with the CMTM assembly procedure is outlined. Author

N71-10381# National Aviation Facilities Experimental Center, Atlantic City, N.J.
HUMAN FACTORS IN USE OF TERMINAL RADAR (ANALOGUE) DISPLAY SYSTEMS Final Report, Jan. 1969 -Jun. 1970
Donald W. Connolly and W. Robert McCosker Nov. 1970 23 p refs
(FAA-NA-70-55; FAA-RD-70-66) Avail: NTIS

An experiment was performed to measure the accuracy with which observers could estimate the separation (distance apart) of two aircraft targets as displayed by continuous film strips of current operational terminal radar equipment. Experimental materials consisted of scan-by-scan photos of two types of display devices; namely, the ASR-4 plan position indicator (PPI) and the RBDE-5 scan-converted PPI. Two types of target or aircraft radar returns were used--primary radar echoes and beacon transponder (secondary radar) returns. Eighteen observers with varying degrees of radar experience made approximately 1,600 judgments of target separation. The mean and variable error or discrepancy between judged separation and displayed (not actual) separation were computed for all combinations of conditions. The major variables (equipment type, target mode, dimension of separation and observer experience) did not have statistically significant effects. Nearly all individual judgments fell within plus or minus 1 1/2 miles of the target separation as displayed to the observer. Author

N71-10382*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A FEASIBILITY STUDY OF LIQUID STERILE INSERTION
D. M. Taylor, G. M. Renninger (Avco Corp.), and M. D. Wardle 21 Jul. 1969 24 p

(Contract NAS7-100)
(NASA-CR-111095; Rept-611-5) Avail: NTIS CSCL 06M

The development of a concept for liquid sterile insertion into a previously sterilized spacecraft and a test program to evaluate the feasibility of such a system are summarized. The system concept developed had two basic criteria: 1) a method of reducing system reliability requirements by verifying the probability of sterility of the filtrate prior to actual insertion into the sterile spacecraft, and 2) a method for verifying the probability of sterility without assaying the filtrate. Author

N71-10393*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PROBLEMS OF SPACE BIOLOGY. VOLUME 10: NERVE MECHANISMS OF VESTIBULAR REACTIONS
A. N. Razumeyev et al Washington NASA Oct. 1970 336 p refs Transl. into ENGLISH of the book "Problemy Kosmicheskoy Biologii. Tom 10: Nerunyye Mekhanizmy Vestibulyarnykh Reaktsiy" Moscow, Nauka Press, 1969 p 4 - 317
(Contract NASw-1692)
(NASA-TT-F-605) Avail: NTIS CSCL 06P

Recent achievements in the electrophysiological investigations of specific links of conducting paths of the vestibular analyzer, its interaction with stimuli, character of impulses arising in the receptor, and the characteristics of their conduction along the vestibular tract are summarized. A significant place is given to questions of the mathematical description of the functioning principles of peripheral portions of the vestibular analyzer, to the stimulation of the activities of the oculomotor apparatus, and to the mathematical treatment of rhythmic changes of neurons in various regions of the cortex and subcortical formations of the brain with adequate stimulation of the vestibular apparatus. Author

N71-10414*# California Univ., Berkeley. Dept. of Nutritional Sciences.
INTEGRATED RESEARCH PROGRAM IN SPACE NUTRITION Semiannual Report, 1 Feb. - 31 Jul. 1970
Doris Howes Calloway, Sheldon Margen, and Rosemarie Ostwald Sep. 1970 14 p refs
(Grant NGR-05-003-351)
(NASA-CR-110908) Avail: NTIS CSCL 06C

Research on the nutrition and breeding behavior of the pocket mouse is reported and includes: (1) Baseline data for the growth of P. pe. fed a diet of mixed seeds were established. This was intended as a preliminary for the determination of the adequacy for growth of a semi-synthetic diet. (2) The study of the effects of photoperiod on estrus behavior of P. pe. was completed. (3) A study of the intestinal absorption and metabolism of calcium, magnesium, and phosphorus by P. pe. was undertaken. Author

N71-10423*# Translation Consultants, Ltd., Arlington, Va.
ON THE CONTINUOUS RECORDING OF FIBRINOLYSIS [ZUR KONTINUIERLICHEN REGISTRIERUNG DES FIBRILLOLYSEVERLAUFES]
E. Kuhnke et al Washington NASA Nov. 1970 8 p refs Transl. into ENGLISH from Pfluegers Arch. (West Germany), v. 272, 1960 p 191 - 194
(Contract NASw-2038)
(NASA-TT-F-13405) Avail: NTIS CSCL 16P

Several examples are used to show that the photometric method is suited for continuous recording of fibrinolysis and fibrinolysis. Author

N71-10426# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
SOME CHARACTERISTICS OF OPTOKINETIC EYE MOVEMENT PATTERNS: A COMPARATIVE STUDY
William E. Collins, David J. Schroeder, Nancy Rice, Ruth Ann Mertens, and Gail Kranz Jul. 1970 31 p refs
(AM-70-10) Avail: NTIS

Optokinetic (OPK) nystagmus is an eye movement reaction which occurs when a series of moving objects crosses the visual field or when an observer moves past a series of objects. Similar continual movement of the eyes (and head) was reported to produce an undesired occupational nystagmus. Responses of animals and men to durations of OPK stimulation varying between 15-120 seconds were examined. Characteristics of the animal responses differed considerably from those of men in both the horizontal and vertical planes. The data were compared with vestibular eye-movement patterns (those which can blur vision during pilot's vertigo) to differentiate aspects of the eye-movement responses which can be attributed primarily to vestibular rather than oculo-motor origins. Author

N71-10435# RAND Corp., Santa Monica, Calif.
TOLERANCE GEOMETRY
Fred S. Roberts Aug. 1970 23 p refs
(AD-710642; P-4430) Avail: NTIS CSCL 6/16

In his work on visual perception, Zeeman points out that any model of perception must take account of the fact that one cannot distinguish between points that are sufficiently close. A similar observation has been made for choice behavior by Luce. This observation suggests that in order to study perception and choice behavior, it is necessary to replace classical geometrical primitives, such as betweeness, straightness, perpendicularity, parallelism, etc., with more general notions, obtained from the classical ones by substituting closeness for identity. The term tolerance geometry is used for any geometry whose primitives are obtained by such a perturbation. This paper gives axioms for tolerance geometry on the line, where the classical ternary relation of betweeness is replaced by the tolerance relation of epsilon-betweeness. In particular, these axioms are stated in terms of a pair (A, B) where A is a finite set and B is a ternary relation on A (epsilon-betweeness). Author (TAB)

N71-10445*# Translation Consultants, Ltd., Arlington, Va.
CIRCADIAN DEVELOPMENT OF RECTAL AND CUTANEOUS TEMPERATURE IN MAN WHILE AT REST IN A CONTROLLED ENVIRONMENT
J. Timbal et al Washington NASA Nov. 1970 4 p refs Transl. into ENGLISH from J. Physiol. (Paris), v. 61, no. 1, 1969 p 181
(Contract NASw-2038)
(NASA-TT-F-13400) Avail: NTIS CSCL 06P

A study of the daily cycles of the rectal and cutaneous temperatures in man when external factors are controlled, is presented. Author

N71-10449# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
A COMPARISON OF THREE SERUM CHOLINESTERASE METHODS
Charles R. Crane, Donald C. Sanders, and John K. Abbott Aug. 1970 9 p refs
(AM-70-13) Avail: NTIS

Aerial applicator personnel dispensing organophosphate pesticides have become increasingly aware of the health and safety benefits of periodic blood cholinesterase (CHE) assays. More precise comparisons of pre-season and in-season values can be made if both measurements are expressed in the same units. Three laboratory methods for assaying CHE were evaluated and the mathematical relationships for interconversion among the three sets of activity units are presented. Author

N71-10480# California Univ., Livermore. Lawrence Radiation Lab. Bio-Medical Div.
AUTOMATIC GEL-FILTRATION APPARATUS FOR THE

PURIFICATION OF LIPID EXTRACTS
Gary J. Nelson 22 Apr. 1970 11 p ref Sponsored in part by AEC
(UCRL-50861) Avail: NTIS

An automatic chromatographic apparatus has been developed which can operate untended once the sample has been introduced, thereby relieving the operator of the inconveniences of the manual procedure. The entire elution sequence for the purification of lipid extracts from various sources is carried out automatically; the process includes the separation of the gangliosides from the other lipids in the sample. The apparatus contains four solvent reservoirs, five program-timers, automatic valves, a metering pump, and one chromatographic column. The design, construction, and operation of the system are described in detail. Author

N71-10499*# Naval Aerospace Medical Inst., Pensacola, Fla. Aerospace Medical Center.
INFLUENCE OF VESTIBULAR STIMULATION AND DISPLAY LUMINANCE ON THE PERFORMANCE OF A COMPENSATORY TRACKING TASK
Richard D. Gilson, Alan J. Benson, and Fred E. Guedry, Jr. Feb. 1970 21 p refs Prepared in cooperation with Army Aeromed. Res. Lab.
(NASA Order R-93)
(NASA-CR-111111; AD-704859; NAMI-1097; NAVMED-MF12.524.004-5001B; USAARL-70-10) Avail: NTIS CSCL 06P

Loss of acuity for visual details in aircraft during unusual maneuvers has been documented. Recent investigations of this problem have served to define the magnitude of semicircular canal stimulation necessary to produce nystagmus of sufficient strength to degrade visual acuity. Present work extends former observations by investigating the effects of levels of illumination during semicircular canal stimulation on the performance of a task requiring vision. The illumination levels were selected to encompass the range used in aircraft cockpits. A compensatory tracking task with an aircraft instrument as the display provided an indirect measure of this loss of visual acuity and a direct practical measure of performance. Author (TAB)

N71-10536# Naval Postgraduate School, Monterey, Calif.
INFORMATION CAPACITY OF DISCRETE MOTOR RESPONSES COMPARED FOR DIFFERENT DIRECTIONS AND AMPLITUDES OF MOVEMENT
Edison Earl Scholes (M.S. Thesis) Sep. 1970 68 p refs
(AD-710713) Avail: NTIS CSCL 5/10

The report describes research and analysis conducted to determine if direction of movement has an effect on the movement and reaction times of personnel when completing discrete motor tasks in response to a visual stimulus. Information theory was an inherent part of the research and was used to specify more precisely an individuals capacity in this area. Linear models were developed which characterize the effect that direction of movement has on movement time. Multiple correlation analysis tested correlation between movement time and the two variables – index of difficulty and direction of movement – used in the models. Author (TAB)

N71-10541*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Final Report, 1 Feb. 1969 - 24 Aug. 1970
David F. Culclasure and Linda Eckhardt 24 Aug. 1970 103 p
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-111131) Avail: NTIS CSCL 06P

The medical institutions participating in the Biomedical Application Team program are listed and their research progress is reported. During the period from 1 February 1969 to 1 September 1970, 11 transfers of technology were accomplished and 29 potential transfers were identified. The transfers of technology include flexible, conducting electrodes for use in treating patients suffering from angina pectoris, instrumentation for use in a screening test for cystic fibrosis, and specialized instrumentation for use in ecological investigations. Author

N71-10575# National Institutes of Health, Bethesda, Md. National Inst. of Environmental Health Sciences.
MAN'S HEALTH AND THE ENVIRONMENT: SOME RESEARCH NEEDS Report of the Task Force on Research Planning in Environmental Health Science
1970 276 p refs
Avail: SOD $1.25

The results are presented of a program to: (1) determine the status of current knowledge, primary problems, impediments to research progress, and objectives in selected areas of environmental health science; and (2) identify key research needs and opportunities, as well as directions and strategies for future developement. The material presented is divided into three main categories that include recommendations for research on (1) specific environmental problem areas; (2) methods and specific disease conditions; and (3) social and behavioral sciences, technological trends, training and organizational needs. D.L.G.

N71-10594# Naval Aerospace Medical Inst., Pensacola, Fla.
ANNOTATED BIBLIOGRAPHY OF REPORTS: SUPPLEMENT NO. 2, 1 JULY 1969 - 30 JUNE 1970
Catherine F. Kasparek and Christine E. Turner, comps. 30 Jun. 1970 37 p refs Supplement to AD-674914
(AD-710764) Avail: NTIS CSCL 6/19

Contents include: Mechanisms underlying disorientation and other vestibular disturbances in flight; Physiological effects of null magnetic fields; Influence of vibrations of flight vehicles on chromosomes; Physiological effects of high magnetic fields; Individual differences with selected sensory stimuli related to orientation and performance in flight; Identification of causes of pilot/vertigo disorientation accidents; Development and improvement in auditory testing methods; Human vestibular function: Motion sickness and other vestibular disturbances in unusual gravitoinertial force environments; Experimental and theoretical studies in radiation hazards on Apollo missions and in supersonic aircraft. TAB

N71-10613# Massachusetts General Hospital, Boston. John Collins Warren Lab.
AN INVESTIGATION OF THE MECHANISM OF PROTEIN AND NUCLEIC ACID SYNTHESIS: A BACKGROUND STUDY RELATED TO THE BIOLOGICAL EFFECTS OF RADIATION Progress Report, 1 Sep. 1969 - 31 Aug. 1970
31 Aug. 1970 12 p refs
(Contract AT(30-1)-2643)
(HUX-2643-60) Avail: NTIS

The mechanisms involved in the biosynthesis of proteins and the possible relationship of radiation to these systems was studied. The details of the early steps in protein synthesis and their relationship to the regulation of growth are discussed. The main focus is on the initial steps of the reaction where an aminoacyl tRNA-synthetase recognizes its own cognate tRNA. There are in reality three distinct sites on the aminoacyl synthetase which are involved in the activation reaction, for the enzyme must recognize the specific amino acid, ATP, and its cognate tRNA. Detailed reports are presented including: further development of micro procedures for oligonucleotide mapping, detection and identification of minor bases in tRNA; studies on the isolation and biochemical characterization of multiple species of methionine specific tRNA from E. coli; optical properties of ribonucleic acids; a search for the tRNA recognition site on the aminoacyl synthetase; attempts to produce in E. coli genetically altered aminoacyl synthetases which

contain mutations in the tRNA recognition area; and an investigation of the dinucleoside polyphosphates formed in vitro by aminoacyl synthetases and attempts to establish their biological significance in vivo. Author

N71-10685# Massachusetts Inst. of Tech., Cambridge. Dept. of Psychology

FACTORS AFFECTING DEPTH PERCEPTION Annual Report

Whitman Richards Jul. 1970 22 p refs

(Contract F44620-69-C-0108)

(AD-711660; AFOSR-70-2364TR) Avail: NTIS CSCL 6/16

The report describes ongoing work on certain factors that affect depth perception. Research has been directed to a study of the relation between depth and disparity, and to obvious individual differences in these relations. This work has led to the discovery that a sizeable portion of the population is stereoblind; many individuals are unable to utilize fully all available disparity cues. The character of these deficits suggests a new basis for depth perception. Author (TAB)

N71-10690# School of Aerospace Medicine, Brooks AFB, Tex.

AUDIOMETER ATTENUATOR CALIBRATION METHOD Final Report, 15 Oct. 1969 - 15 Apr. 1970

F. A. Brogan Jul. 1970 12 p ref

(AD-711659; SAM-TR-70-40) Avail: NTIS CSCL 6/5

The implementation of standards for audiometers--together with a general upgrading of those for audiometer calibration--requires calibration checks of the steps of the audiometer hearing-level attenuator. The aim of the study was to determine the feasibility of using transformer and common base preamplifier impedance-matching, in conjunction with laboratory voltmeters or sound-level meters, to detect the very-low-level electrical signals from the audiometer. Additional applications of this device are suggested. Author (TAB)

N71-10692# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

PHYSIOLOGIC RESPONSES TO SHORT DURATION G SUB z Final Report

George H. Kydd and Archie Ashley 14 Aug. 1970 40 p refs

(AD-710986; NADC-MR-7012) Avail: NTIS CSCL 6/19

Subjects were subjected to Gz (positive) haversine accelerations of short duration, high magnitude on the centrifuge and their responses to peripheral lights have been recorded. Whereas, most subjects lost the peripheral lights during the 6-second haversine, only one did so during the 4-second run. Since the acceleration is maximum one half way through these accelerations this means that a rise time to 6 Gz in 3 seconds was more effective in producing peripheral light loss (P.L.L) than a rise to 10 Gz in 2 seconds. The data thus indicate that the response tends to become independent of maximum Gz and become more a function of the duration of the acceleration. With the shorter duration haversine (10 and 8 seconds) the response tends to occur after maximum Gz when acceleration is decreasing. Author (TAB)

N71-10695# Naval Aerospace Medical Inst., Pensacola, Fla.

ORIENTATION-ERROR ACCIDENTS IN THE REGULAR ARMY AIRCRAFT DURING FISCAL YEAR 1967: RELATIVE INCIDENCE AND COST

Carroll W. Hixsom, Jorma I. Niven, and Emil Spezia 22 Jun. 1970 51 p refs

(AD-710987; NAMRL-1107; NAVMED-MF12.524.005-5016B) Avail: NTIS CSCL 1/2

The report deals with the magnitude of the pilot disorientation/vertigo accident problem in Regular Army fixed wing and rotary wing flight operations. Factors involved in the development of an operational definition of the orientation-error class of aircraft accidents are discussed. Incidence and cost data presented for fiscal year 1967 include a total of 57 major and minor orientation-error accidents (19 of which were fatal), resulting in 45 fatalities, 105 nonfatal injuries, and a total aircraft damage cost of $10,144,034. The contribution of rotary wing orientation-error accidents to this total was 55 accidents (18 of which were fatal), resulting in 44 fatalities, 104 nonfatal injuries, and a total aircraft damage cost of $10,116,847. Author (TAB)

N71-10712# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

COMPARISON OF AIR POLLUTION MODELS WITH AEROMETRIC DATA FOR THE AIR QUALITY REGION CENTERED ON NEW YORK CITY

S. N. Milford, G. C. McCoyd, L. Aronowitz, and J. H. Scanlon Oct. 1970 54 p refs Presented at the 2d Intern. Air Pollution Conf., Washington, D.C., 6 - 11 Dec. 1970

(RE-392J) Avail: NTIS

A steady-state, nondivergent, Gaussian model was investigated to determine the improvement that empirical corrections add to computerized simulation of air quality. Determinations were made by matching observations and calculations of the stability classes which provide the best predictions. In the third of three stages considered, the data are divided into six categories corresponding to three wind speed ranges and two mixing depths representing day and night. Monthly average stability classes are determined for each category from the data at nine measuring stations. Hourly validation calculations for sulfur dioxide at the individual telemetry stations of the aerometric network were made using the average stability values. The monthly averages of the calculated concentrations agree with average measured values within a factor of two for most stations and categories. Author

N71-10723# Naval Medical Neuropsychiatric Research Unit, San Diego, Calif.

AQUANAUT SLEEP PATTERNS DURING TEKTITE 1: A 60 DAY HABITATION UNDER HYPERBARIC NITROGEN SATURATION Final Report

Paul Naitoh, Laverne C. Johnson, and Marion Austin 1970 36 p refs

(AD-711671; Rept-70-36) Avail: NTIS CSCL 6/19

Four aquanauts lived in the TEKTITE I habitat at a 43-foot depth of sea water for 60 days under nitrogen saturation. The effects of this underwater habitation on quality and quantity of sleep were studied by sleep logs for all four aquanauts; and by electroencephalogram (EEG), electroculogram (EOG), and electrocardiogram for two aquanauts on selected nights during the dive. Sleep was not a problem during the dive. Compared to pre- and postdive records, total sleep time increased during the dive. EEG delta activity, recorded from two aquanauts during sleep in TEKTITE I, was elevated over baseline levels. As the dive progressed, time of going to bed shifted to a later hour as did the time of arising in three aquanauts. Sleep logs agreed with EEG and behavioral data with respect to hours of sleep. Heart rate during sleep was increased in TEKTITE I compared to pre- and postdive sleep heart rates. Author (TAB)

N71-10753# School of Aerospace Medicine, Brooks AFB, Tex.

A COMPARATIVE STUDY OF THE EFFECTS OF ULTRAVIOLET RADIATION ON THE EYE Final Report, 1 Oct. 1968 - 30 Sep. 1969

Donald G. Pitts, William R. Bruce, and Thomas J. Tredici Jul. 1970 83 p refs

(AD-711360; SAM-TR-70-28) Avail: NTIS CSCL 6/18

A fluid transpiration arc (FTA) filled with argon gas was used to produce a high intensity continuous spectrum. Animal and human exposures were made to establish the photokeratitis

threshold and abiotic action spectrum. The abiotic action spectrum ranged from 210 to 320 nm. The peak of the ultraviolet threshold curve was at 270 nm for the rabbit and the primate. The rabbit photokeratitis threshold was 0.05 X 10 to the 6th power ergs/sq cm at 270 nm. The primate threshold was 0.04 X 10 to the 4th power ergs/sq cm at 270 nm. The human threshold at 280 nm was 0.05 X 10 to the 6th power ergs/sq cm. Formulas and calculations are given for protection against ultraviolet encountered in the space environment. Author (TAB)

N71-10810# Woods Hole Oceanographic Institution, Mass.
CHEMICAL EVOLUTION OF PHOSPHATES, PART 3
[1970] 111 p refs
Avail: Issuing Activity

The mechanism by which inorganic and mineral phosphate groups become part of the cellular structure is considered. It is proposed that some time between the formation of abiotic organic molecules and their final organization into the cell, a number of phosphate compounds interacted with the prebiotic structures of life. The criteria used in the study are derived from the knowledge of cellular chemistry and from the understanding of geochemical processes operating in geological environments that occurred at or close to the surface of the earth millions of years ago. Each reaction step is considered independently and the reason for its formulation and selection is outlined. The merger of metabolism and genetic control devices which lead eventually to the formation of a primordial cell is considered, with emphasis on the principle of crystallinity as the basis of all molecular processes. See also N70-32861 and N70-32862. R.B.

N71-10881# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN PERFORMANCE EFFECTS OF REPEATED EXPOSURE TO IMPULSIVE ACOUSTIC STIMULATION Final Report, Aug. 1969 - Jan. 1970
C. Stanley Harris Apr. 1970 22 p refs
(AD-711637; AMRL-TR-70-38) Avail: NTIS CSCL 6/19

To determine the effects of repeated exposure to an impulsive auditory stimulus, ten subjects were tested on a pursuit rotor task during exposure to the stimulus for four consecutive days. The stimulus (peak intensity of 112 dB with a 400 millisecond duration) was presented nine times on each day in a semi-random fashion. Performance of these subjects was compared to the performance of an additional group of ten subjects who served as a control group. Author (TAB)

N71-10883# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
BASIC KINEMATICS AND DYNAMICS OF THE HUMAN CENTRIFUGE AND OTHER AEROSPACE SIMULATORS, INCLUDING A SIMPLE EXPLANATION OF CORIOLIS AND GYROSCOPIC EFFECTS
Otto Schueller and Fred W. Berner May 1970 38 p
(AD-711635; AMRL-TR-69-126) Avail: NTIS CSCL 6/19

This treatise is intended to familiarize medical and technical monitors of experiments on human centrifuges and other dynamic flight simulators with the various inertia effects produced by these facilities. It should fill the gap between the most elementary superficial explanations and the complicated derivations of these effects by abstract vector differential equations. The centrifugal, Coriolis, and gyroscopic effects are explained simply and in a manner that everybody interested in this field should be able to understand. Author (TAB)

N71-10891# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMBINED EFFECTS OF NOISE AND VIBRATION ON MENTAL PERFORMANCE AS A FUNCTION OF TIME OF DAY Final Report, Feb. 1969 - Mar. 1970
Henry C. Sommer and C. Stanley Harris Jul. 1970 20 p refs
(AD-711636; AMRL-TR-70-36) Avail: NTIS CSCL 6/19

To determine the combined effects of noise and vibration on mental performance as a function of time of day, subjects were randomly exposed to each of the following conditions: stress (5 Hz vibration, 110 dB noise) at 6 AM; no stress (no vibration - 85 dB noise) at 6 AM; stress at 3 PM; and no stress at 3 PM. Subjects performance on a mental arithmetic task was measured during each of these exposures on consecutive days. The average exposure time was approximately 20 minutes. The results are discussed in the context of arousal theory. Author (TAB)

N71-10952# Joint Publications Research Service, Washington, D.C.
MAMMAL REACTION TO HYDRODYNAMIC FORCES STUDIED
Yu. G. Aleyev 21 Oct. 1970 11 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 49, no. 8, 1970 p 1173-1180
(JPRS-51614) Avail: NTIS

An experimental study of the pattern of movement of dolphin and human bodies using an underwater camera demonstrated the possibility of the passive formation of mobile roughness in the skin of mammalia, due exclusively to the effect of external hydrodynamic forces. It is noted that this mobile roughness of running waves of deformation in the skin facilitate the reduction of hydrodynamic resistance. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-10006# Harry Diamond Labs., Washington, D.C.
ARMY HEART MONITOR: MODEL 4
Charles W. Ragsdale Mar. 1970 135 p refs
(AD-710221; HDL-TM-70-2) Avail: NTIS CSCL 6/2

Model 4 of the Army Heart Monitor is an electronic device that monitors the electrocardiogram (ECG); sounds an alarm on diagnosing a high or low heart rate, excess electrical noise, cardiac arrest, or ventricular fibrillation; and displays the diagnosis on a meter. Ventricular fibrillation is sensed on the basis of five parameters related to the shape and rate of occurrence of the ECG signals. A noise discrimination system using several frequency and pulse-width criteria allows accurate determination of heart rate when the ECG signal is accompanied by high levels of electrical noise. The monitor will function for long periods on self-contained batteries and will operate in the military temperature range. Because it operates automatically (analysis of an ECG by trained personnel is unnecessary), it may be used in situations where oscilloscopes and paper writers are not available or where their use is not feasible. Author (TAB)

N71-10026*# Tracor, Inc., Austin, Tex.
PUBLIC REACTIONS TO SONIC BOOMS
Washington NASA Sep. 1970 317 p refs
(Contract NASw-1704)
(NASA-CR-1665) Avail: NTIS CSCL 05K

The nature of public reaction to sonic booms was assessed in selected metropolitan areas of the United States. The major social or psychological factors were identified that are associated with one or another type of public reaction to sonic booms of relatively modest overpressure levels. The sonic booms were generated by the supersonic SR-71 reconnaissance airplane during Air Force training and test flights. A bibliography of boom studies

and a bibliography re news media studies are included. A tentative causal model relating the hearing of sonic booms to attitudes and reactions indicates that a negative attitude to the boom must be developed before the respondent reports an increase in disturbance of his activities. It is this disturbance of activities that then relates to the level of annoyance of the respondent. The importance of this finding is that the reaction pattern appears to be different for sonic booms and subsonic aircraft noise. Author

N71-10286# National Academy of Sciences-National Research Council, Washington, D.C.

A STUDY OF TRANSPORTATION OF HAZARDOUS MATERIALS

31 Jul. 1969 277 p refs

(Contract DOT-OS-A9-106)

(AD-692182) Avail: NTIS CSCL 15/5

The findings of a technical and engineering investigation of hazardous materials transportation by highway, rail, air and water are presented. The aspects of the overall problem studied are the transportation environment, hazard classification, packaging, and hazardous identification. F.O.S.

N71-10340*# Translation Consultants, Ltd., Arlington, Va.

SOME RESULTS OF THEORETICAL AND EXPERIMENTAL STUDIES OF MASS EXCHANGE IN LIFE SUPPORT SYSTEMS DURING A ONE-YEAR MEDICAL TECHNOLOGICAL EXPERIMENT [NEKOTORYYE REZULTATY TEORETICHESKOGO I EKSPERIMENTAL'NOGO ISSLEDOVANIYA MASSOOBMENNYKH KHARAKTERISTIK SISTEM ZHIZNEOBESPECHENIYA V GODOVOM MEDIKO-TEKHNICHESKOM ESKPERIMENTE]

B. A. Ademovich et al Washington NASA Nov. 1970 20 p Russian Presented at the 21st Intern. Astron. Congr., Constance, West Ger., 4-10 Oct. 1970

(Contract NASw-2038)

(NASA-TT-F-13371) Avail: NTIS CSCL 06K

The practice of life support system development and analysis has demonstrated the need for coordination of theoretical and experimental studies. Two main directions in theoretical investigation are briefly outlined. The first is concerned with the elaboration of a theory for life support system development, quality evaluation and selection of algorithms to control the system as a whole. The second direction of theoretical investigation consists in isolation of the links with processes not connected (or slightly connected) to those in the rest of the system, and includes simulation and optimization of autonomous links. Some results of experimental studies in course of the one year medical technical experiment are described, concerning the intensity of mass exchange processes in man. The principal directions of experimental studies are discussed and characteristics of the rates of CO2 excretion, O2 consumption, urine elimination and water consumption are given. Author

N71-10472# General Electric Co., Philadelphia, Pa. Space Div.

WASTE MANAGEMENT SYSTEM FUNCTIONAL MODEL Final Report, Feb. - Oct. 1969

Joseph R. Katz and Robert W. Murray May 1970 46 p

(Contract F33615-69-C-1372)

(AD-710623; AMRL-TR-69-137) Avail: NTIS CSCL 6/11

A functional model for the collection and storage of fecal wastes in a biologically safe and psychologically acceptable manner for aerospace vehicles has been designed, fabricated and successfully tested. The design is a commode type collector similar to the previously developed Dry-John slinger system; however, the new design extends the useful life of the previous unit by use of a replaceable liner. The functional model provides vacuum drying and storage of 200 man-days of feces and toilet tissue prior to liner replacement. Each liner contains a motor-slinger and an air flow bacteria filter. The filter prevents contamination of all downstream lines and permits changing of the liner without contamination of the cabin. The full liner can be sealed and stored while the new liner functions for an additional 200 man days; thus, the useful life of the basic hardware is governed by the number of available liner assemblies, and cabin storage. Additional features of the functional model are a quick acting slide valve assembly to open and close the commode, provision for feces sampling and a subassembly for dispensing a disinfectant onto the feces. Author (TAB)

N71-10699# Air Force Cambridge Research Labs., Bedford, Mass.

DURATION AND UNUSUAL EXTREMES OF COLD

Irving I. Gringorten 26 Jun. 1970 35 p refs *Its* Environ. Res. Papers No. 326

(AD-710611; AFCRL-70-0381) Avail: NTIS CSCL 15/5

Duration, in hours and days, of low temperature during which equipment must operate and long term durations of extreme cold which equipment should withstand without irreversible damage, are provided in the revision of MIL-STD-210A, Climatic Extremes for Military Equipment. A low temperature of -60F was established (in guidance from the Joint Chief of Staff) at which equipment should still be operable. But still lower temperatures, persisting from one to several days, at which the equipment must be able to withstand on standby for periods of 2 to 25 years, had to be inferred by modelling, to supplement the evidence of several scant data sources in the remote frigid areas of the world. The operational 20 percent extreme cold, equalled or exceeded continuously for 12 hours in the cold heart of Siberia, is -60F. The withstanding 10 percent extreme is lower than -80F in 2 to 4 days exposure for a planned life of 2 to 25 years. Author (TAB)

N71-10844# Naval Postgraduate School, Monterey, Calif.

A SIMULATOR EVALUATION OF PILOT PERFORMANCE AND ACCEPTANCE OF AN AIRCRAFT RIGID COCKPIT CONTROL SYSTEM

Donald M. Layton 15 Jul. 1970 97 p refs

(AD-711296; NPS-57LN70071A) Avail: NTIS CSCL 5/10

A ground-based simulator facility employing a two-axis compensatory tracking task with a random appearing signal was used to evaluate the performance of one hundred five pilot and non-pilot test subjects using four separate control sticks -- two moveable and two rigid. Pilot acceptance of the rigid cockpit controllers was determined by comparing individual pilot ratings of the sticks. In general, in both performance and opinion, the rigid systems were found to be superior to their moveable counterparts. Steps were taken to avoid errors due to pilot bias, learning, fatigue, or adaptation. The results obtained are subject to several test limitations, including the low stick-force levels employed the lack of aircraft vibration effects, and the realism of the simulation. Author (TAB)

N71-10880# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

THE USE OF COMPUTERS FOR MAN-MACHINE MODELLING: STATUS AND PLANS

Gerald P. Chubb, Julie T. Apter, William W. Graessley, Lorenz P. Schrenk, and Patrick W. Ryan Jun. 1970 77 p refs

(AD-711638; AMRL-TR-70-60) Avail: NTIS CSCL 5/8

Four papers, each describing a different approach to modelling man, are presented. The first paper describes an extension of the servo theoretic approach to describing the human operator as an active element of a control system. The model presented has been developed to describe and predict muscular actions. The second paper addresses the monte carlo simulation of human performance within a task and time analytic framework, and illustrates the current state-of-the-art. A third paper deals with man-computer interaction in information-processing and decision-making tasks. An attempt was made to describe such interactions in a manner that

facilitates the allocation of tasks to man and the computer. The fourth paper demonstrates the feasibility of graphically portraying human biomechanical movements on an IBM graphic display console. Such techniques can simulate human movements and aid the designer in optimizing workplace geometry. Together, these papers illustrate the breadth of techniques available for modelling man in a man-machine environment. Author (TAB)

N71-10947# IIT Research Inst., Chicago, Ill.
EXPLORATORY DEVELOPMENT OF PRESSURE SUIT MOBILITY JOINTS, GLOVES AND HELMET Final Report, Mar. 1966 - Apr. 1969
Jozef Slowik, Alfred Marcum, and Marvin Burns Wright-Patterson AFB, Ohio AMRL Apr. 1970 115 p
(Contract AF 33(615)-3468)
(AD-711676; IITRI-J6028-FR; AMRL-TR-69-64) Avail: NTIS CSCL 6/11

A research program was conducted to investigate and develop approaches for improving pressure suit mobility and comfort. Novel concepts were generated and unique properties of materials were exploited to implement these concepts for various pressure suit components. Single plane mobility joints of low profile fabric materials were made with mobility approaching that of hard joints. Work was begun to adapt the same principles to biaxial joints. Advanced concepts for improving the tactility and mobility of pressure gloves were implemented in several models of experimental gloves. Exploratory development of partial pressure helmet was initiated. As a part of the broad systems study, the thermal control problems and micrometeoroid threat to the extravehicular crewman were also investigated. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-10083*# Pennsylvania State Univ., University Park. Materials Research Lab.
LUMINESCENCE OF OXIDES BY OH ACTIVATION IN HYDROGEN FLAMES
John R. Sweet, William B. White, Rustum Roy, and Heinz K. Henisch *In its* Space Appl. of Solid State Luminescent Phenomena 1970 p 61 (See N71-10076 01-30)
Avail: NTIS CSCL 07D

Candoluminescence is a name applied to liminescence excited by flames (the nonthermal part of the emission of a hot phosphor). In the course of re-examination of this phenomenon we have found efficient low temperature emission from many rare earth and transition ion doped phosphors. The flame-excited luminescence was obtained by playing a hydrogen diffusion flame over the phosphor surface. Experiments with gases in a microwave discharge show that the luminescence is excited by the discharge from water vapor but not from hydrogen. Indeed, hydrogen quenches the luminescence. It is postulated that the activating species is an excited state of neutral OH. The results of these investigations, including the mechanism of activation, is of potential interest to the explanation of transient phenomena on the moon and other planetary surfaces. Author

N71-10084*# Pennsylvania State Univ., University Park. Materials Research Lab.
DETAILED CATHODOLUMINESCENCE CHARACTERIZATION OF COMMON SILICATES
H. Goerz, R. J. R. S. B. Bhalla, and E. W. White *In its* Space Appl. of Solid State Luminescent Phenomena 1970 p 62 70 refs (See N71-10076 01-30)
Avail: NTIS CSCL 07D

A scheme for the detailed cathodoluminescence characterization of minerals was developed. Important features recorded were: color of emission, intensity and intensity variations, change with exposure to the electron beam, polarization properties, and rise and decay times. The predominant cathodoluminescence colors were red and blue. The relative efficiencies of most of the samples studied were on the order of 2% or smaller and the rise and decay times follow at a constant value of around 0.2 to 0.3 ms. It was decided that the similarity in the behavior of these minerals is due to the intrinsic luminescence characteristics of the SiO4 groups. Only kunzite differed markedly from the other minerals. Author

N71-10098# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF THE CONCENTRATION DEPENDENCE OF THE TRANSLATIONAL FRICTION COEFFICIENT
V. P. Budtov 28 May 1970 21 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim (Leningrad), v. 4, no. 1, 1969 p 78 88
(AD-710294; FTD-HT-23-235-70) Avail: NTIS CSCL 7/4

The concentration dependence of the translational friction coefficient f of a solution of macromolecules was analyzed. It was shown that it is impossible to construct a theory of concentration dependence f on the basis of the Stokes solution for a uniform unbounded medium. It is necessary to take into consideration deviations of the real velocity of the solvent in the presence of dissolved particles from the Stokes solution. The Navier-Stokes equations were solved for motion of a particle in a closed sphere. It was shown that the obtained solution satisfies the real picture of motion of macromolecules in the solution, since strict calculation of the total velocity of the entrainment of solvent by moving particles is equal to the velocity of the solvent, calculated simply from the continuity equation. The proposed theory permits us to describe the existing experimental material for solutions of macromolecules. Author (TAB)

N71-10265*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POLYMER RESEARCH: PROPULSION DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 125 145 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 07C

Results are reported of research on the kinetics of oxidation of styrene-butadiene rubber by infrared spectroscopy, the molecular-sieve catalyzed polymerization of isobutylene, sterilizable battery separator membranes, the functionality of isobutylene prepolymers, and evaluation of spacecraft magnetic recording tapes. R.B.

N71-10304*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry.
NUCLEAR CHEMISTRY AND GEOCHEMISTRY RESEARCH Progress Report, 1969 - 1970
Truman P. Kohman 30 Jun. 1970 115 p refs
(Contracts NAS9-8073; AT(30-1)-844)
(NASA-CR-111001; NYO-844-81) Avail: NTIS CSCL 07E

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11. CHEMICAL PROCEDURES FOR PURIFICATION OF URANIUM AND THE ALPHA-SPECTROSCOPY OF URANIUM N. Kan p 83 - 90 refs (See N71-10315 01-06)

12. ALPHA-ISOTOPE-DILUTION ANALYSIS OF URANIUM AND THORIUM B. M. P. Trivedi p 91 - 96 refs (See N71-10316 01-06)

13. LEAST-SQUARES ANALYSIS OF EXPERIMENTAL ALPHA SPECTRA B. M. P. Trivedi p 97 104 refs (See N71-10317 01-24)

14. DESIGN AND CONSTRUCTION OF A POSITION-SENSITIVE PROPORTIONAL COUNTER J. R. Yocum, Jr. and J. F. Monahan p 105 - 109 refs (See N71-10318 01-14)

15. A UNIVERSAL MAGNITUDE SYSTEM FOR ASTRONOMICAL OBJECTS T. P. Kohman p 110 - 111 (See N71-10319 01-30)

N71-10305*# Carnegie-Mellon Univ., Pittsburgh, Pa.
INVESTIGATION OF Sm146/Nd142 AND Sm147/Nd143 AS DATING METHODS
Ramzi Y. Saleh *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 6 - 13 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07E

Investigation of Sm-146 Nd-142 and Sm-147 Nd-143 systems for their potential applications to geochronology has been continued. The utilization of these systems as dating methods will depend on the extent of Sm Nd fractionations in natural materials. Mass spectrometry of 1-5-microgram samples of standard solutions of natural neodymium and samarium has been found to be quite feasible. Author

N71-10309*# Carnegie-Mellon Univ., Pittsburgh, Pa.
ISOTOPIC COMPOSITION OF LEAD AND THALLIUM IN NATURAL MATERIALS
James M. Huey *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 37 - 45 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07E

Data obtained from the isotopic analysis of lead in many natural materials have already found widespread interpretations in the field of geochronology and have been applied to the development of theories of nucleosynthesis. In addition, it may be possible to extend the fine time-resolution of the interval following nucleosynthesis through application of the principles of extinct natural radioactivity to the Pb-205 Te-205 system and isotopic analyses of thallium. Data on the isotopic compositions and concentrations of lead and thallium in stone meteorites, particularly the carbonaceous chondrites, should be important in the search for extinct natural radioactivity of Pb-205, and lead data, when coupled with uranium and thorium concentration values will further the understanding of the history of these extra-terrestrial bodies. Author

N71-10310*# Carnegie-Mellon Univ., Pittsburgh, Pa.
CHRONOLOGY OF GALACTIC HEAVY-ELEMENT NUCLEOSYNTHESIS
James M. Huey and Truman P. Kohman *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 46 - 56 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07E

Three quite independent methods for obtaining quantitative estimates or lower limits of the age of the universe have been discussed with the conclusion that each of these methods yields results consistent with an age between about 8 and 25 Gy: (1) calculation of model ages of the oldest stars from the main-sequence cut-off points in color-luminosity diagrams for star clusters; (2) determination of model parameters for a monotonically expanding universe from galactic red-shifts; and (3) evaluation of parameters in models of galactic nucleosynthesis from relative abundances of radioactive and stable products. Undertaken is a refinement of the third method, using chiefly a model for galactic nucleosynthesis proposed earlier with recent values of cosmochemical and nuclear-physical data. Author

N71-10313*# Carnegie-Mellon Univ., Pittsburgh, Pa.
GENERAL SCHEME OF CHEMICAL ANALYSIS OF LUNAR AND METEORITIC SAMPLES
H. Ihochi *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 69 - 75 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07D

The proposed schemes for the analyses of lunar samples are summarized as block diagrams. The separation scheme for the mass-spectrometric elemental abundance determination is very similar to the scheme for the preparation of samples for the isotopic-composition determination of the elements in question. The investigation of the system in lunar samples has been discontinued tentatively because of extremely low concentrations of Ag in Apollo 11 samples, and the indications of a rather long time from the termination of r-process nucleosynthesis to the formation of cool meteoritic solids. Author

N71-10315*# Carnegie-Mellon Univ., Pittsburgh, Pa.
CHEMICAL PROCEDURES FOR PURIFICATION OF URANIUM AND THE ALPHA-SPECTROSCOPY OF URANIUM
Nancy Kan *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 83 - 90 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07E

This report describes a chemical procedure of isolation and purification of traces of uranium to determine the U234/U238 activity ratio of alpha-particle spectrometry. Author

N71-10316*# Carnegie-Mellon Univ., Pittsburgh, Pa.
ALPHA-ISOTOPE-DILUTION ANALYSIS OF URANIUM AND THORIUM
Brij M. P. Trivedi *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 91 - 96 refs (See N71-10304 01-06)
Avail: NTIS CSCL 07E

The present work aims at quantitative determination of uranium and thorium in natural samples, with special interest in meteorites and lunar materials by the radiometric alpha-isotope-dilution technique using U232 and Th 228 as spikes. Author

N71-10451# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
FUNDAMENTAL STUDIES OF SEPARATION PROCESSES
Technical Progress Report

L. B. Rogers Jul. 1970 14 p refs
(Contract AT(11-1)-1222)
(COO-1222-40) Avail: NTIS

High precision gas chromatography was applied to obtain differential measurements of heats and entropies of solution, adsorption isotherms from tailed chromatographic peaks, improved sensitivity in trace analyses through ensemble averaging, further indications of the effects of adsorbent porosity on peak shape, and useful analytical data from overlapped chromatographic runs. Preliminary data on the methyl orange system revealed unusual polymerization behavior. In the area of gel chromatography, preliminary evidence appears to indicate that use of a wide column may sometimes be advantageous because of the ease of working at very low linear flow rates while maintaining a reasonable rate of throughput. Author

N71-10468# Midwest Research Inst., Kansas City, Mo.
A STUDY OF THE ELECTRIC DEFLECTION OF MOLECULAR BEAMS Final Technical Report, Jul. 1969 Jun. 1970
Frank T. Greene and Thomas A. Milne Jun. 1970 50 p refs
(Contract F44620-69-C-0075)
(AD-710656; AFOSR-70-1874TR) Avail: NTIS CSCL 7/4

An electric deflection molecular beam system with a mass spectrometric detector was built and tested and is operating satisfactorily. The entire system is bakeable to 400C in order to minimize interfering background gases, and can be operated at pressures approaching 10 to the -10th torr. Computer data reduction schemes for non-polar and linear molecules having both permanent and induced electric moments have been developed and tested and are in use. The system was applied to the study of alkali metals and their dimers and alkali metal halides and their polymers. Some experiments with supersonic nozzle beams were also carried out. Author (TAB)

N71-10469# Brown Univ., Providence, R.I.
PREPARATION AND PROPERTIES OF Fe2P Technical Report, 1 May 1969 30 Apr. 1970
David Bellavance, James Mikkelsen, and Aaron Wold Jul. 1970 27 p refs
(Contract F33615-69-C-1177)
(AD-710697; AFML-TR-70-102) Avail: NTIS CSCL 20/3

The system Fe(2-delta)P, with the Fe2P structure, was studied where delta varies from 0 to 10. The bulk magnetic properties of these phases have been investigated and correlated with deviations in stoichiometry. Fe2P and Fe(1.91)P have Curie temperatures of 225K and 223K respectively; the observed magnetic moment of these materials varied from 1.28mu(B)/Fe(1.91)P to 1.10mu(B)/Fe atom for Fe2P. The electrical resistivity of single crystal Fe(1.91)P was measured from 80K to 360K. Metallic behavior was observed throughout this temperature range. A break in the resistivity curve occurred at 220K and coincides with the abrupt change in the magnetization curve. Author (TAB)

N71-10507# National Bureau of Standards, Washington, D.C.
INSTITUTE FOR MATERIALS RESEARCH: TECHNICAL HIGHLIGHTS, FISCAL YEAR 1969
1969 68 p
Avail: Issuing Activity

Preparation and characterization of materials, standard reference materials, data on the properties of materials, and technical assistance are discussed. Standards of measurement for the commercial, industrial, and educational communities are being developed. Author

N71-10513# Technische Univ., Berlin (West Germany). Fakultaet fuer Maschinenwesen.
A SIMULATION MODEL FOR THE INCREASE OF CHEMICAL ACTIVITY AT CRYSTAL SURFACES THROUGH PARALLEL IMPACT OF SOLID PARTICLES [EINE MODELLVORSTELLUNG UEBER DIE STEIGERUNG DER CHEMISCHEN AKTIVITAET VON KRISTALLOBERFLAECHEN DURCH PRALLBESCHUSS MIT FESTSTOFFKOERNCHEN]
Rainer Schoene (Ph.D. Thesis) Aug. 1968 126 p refs In GERMAN
Avail: NTIS

A mathematical model is developed that describes chemical effects at crystal surfaces which are triggered by supervelocity impact of solid particles. A functional relationship between surface activation and effecting parameters is obtained that considers the velocity, mass, and impact frequencies of the particles and the direct proportional increase in activity and absorbed mechanical energy. Transl. by G.G.

N71-10514# Technische Univ., Berlin (West Germany). Fakultaet fuer Maschinenwesen.
STUDIES ON THE KINETICS OF CARBON MONOXIDE OXIDATION WITH OXYGEN [UNTERSUCHUNGEN ZUR KINETIK DER OXYDATION VON KOHLENMONOXID MIT SAUERSTOFF]
Dirk Stahlmann (Ph.D. Thesis) 1968 93 p refs In GERMAN
Avail: NTIS

Differential reactor measurements on carbon monoxide oxidation established additive transfer reactions depending on temperatures and radical concentrations. It is shown that reaction flow depends on the transportation flow at high temperatures if reaction velocity and reaction intensity of the carbon monoxide concentration are proportional. Transl. by G.G.

N71-10525# Technische Univ., Berlin (West Germany). Fakultaet fuer Bergbau und Huettenwesen.
STIRRING EFFECTS ON MULTIPLE PHASE MIXING [BEEINFLUSSUNG DES MISCHENS MEHRERER PHASEN DURCH RUEHREN]
Ulrich Bimler (Ph.D. Thesis) 1968 94 p refs In GERMAN
Avail: NTIS

The effects of various stirring methods on mass transfer in gaseous-liquid-, liquid-solid-, and gaseous-liquid-solid systems are determined for conditions comparable to pressure leaching in autoclaves. Considered are suction absorption mixers and the use of ultrasound waves for accelerating mass transfer flow. Transl. by G.G.

N71-10572# Army Electronics Command, Fort Monmouth, N.J.
TRANSIENT IMPEDANCE TECHNIQUE FOR THE STUDY OF ELECTRODE KINETICS: APPLICATION TO POTENTIOSTATIC METHODS
Arthur A. Pilla Feb. 1970 46 p refs
(AD-710945; ECOM-3239) Avail: NTIS CSCL 7/4

A generalized approach to the study of the dynamic behavior of electrochemical systems is presented in terms of the transient impedance technique. It is shown that interpretation of the time domain electrode response to an arbitrary perturbation by conversion of both functions to the frequency domain allows maximum usage of experimental information with minimum ambiguity. The basis for the use of aperiodic equivalent circuits to represent active or passive electrodes is considered and sample, rigorously derived, circuits are presented. The equivalent circuit approach is thus generalized and it is shown how its use may constitute a convenient shorthand notation for the rigorous solution of the differential equations used to describe a particular electrode model. Application of the transient impedance method to potentiostatic techniques is presented with emphasis upon the manner in which this approach allows instrumental errors and artifacts to be eliminated particularly at high frequencies. Author (TAB)

N71-10675# National Bureau of Standards. Analytical Coordination Chemistry Section.
ANALYTICAL COORDINATION CHEMISTRY SECTION: SUMMARY OF ACTIVITIES, JULY 1969 TO JUNE 1970
O. Menis and J. I. Shultz, eds. Sep. 1970 153 p refs
(NBS-TN-544) Avail: SOD $1.25 Catalog No. C-13.46:544

Reported research and development activities have been directed towards standard reference materials. Reissued were two clay standards; two new standards for thermal analysis by absorption spectrophotometry and flame spectroscopy were established for determining the various elements in simulated lunar glasses. Programs are under way for the development of standards to calibrate or check absorbance-transmission scales in spectrophotometry and spectrofluorimetry. Author

N71-10741*# Stanford Univ., Calif. Dept. of Computer Science.
A HEURISTIC PROGRAM FOR SOLVING A SCIENTIFIC INFERENCE PROBLEM: SUMMARY OF MOTIVATION AND IMPLEMENTATION
Joshua Lederberg, Georgia L. Sutherland, Bruce G. Buchanan, and Edward A. Feigenbaum Nov. 1969 16 p refs Submitted for publication Sponsored in part by NASA
(Contract ARPA SD-183)
(NASA-CR-111092; AD-709055; SU-AIM-104) Avail: NTIS CSCL 07D

A brief summary is presented describing the development of the HEURISTIC DENDRAL program for identifying mass spectra. TAB

N71-10766# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE KNOWLEDGE OF COMPLEX CHEMICAL BEHAVIOR OF MANGANESE(I) AND RHENIUM(I) CARBONYL HALIDES [ZUR KENNTNIS DES KOMPLEXCHEMISCHEN VERHALTENS VON MANGAN(I)- UND RHENIUM(I)-CARBONYLHALOGENIDEN]
Friedrich Stanner (Ph.D. Thesis) 1969 47 p refs In GERMAN
Avail: NTIS

The reaction of diphenyl chalcogen ether with manganese carbonyl halides is studied with respect to formation of mononuclear compounds. Novel complexes are formed from reactions of diphenyl sulfide derivatives with oxygen ligands and water. Hydroxydiaquo tricarbonyl manganese originates from diaquo tricarbonyl manganese iodide through HI separation. The reaction-carrying diphenyl selenium derivative reacts primarily with hydrated S-heterocycles to form nonionic complexes. The 1,2 and 1,3 diketones behave like binary ligands in formation of stable five- and six-ring chelate complexes, which are not inner complexes. The structure of the resulting compounds is studied by infrared and mass spectroscopy, molecular weight measurements, precipitation reactions, and conductivity measurements. Transl. by R.B.

N71-10805# Oak Ridge National Lab., Tenn.
THERMODYNAMIC PROPERTIES OF AQUEOUS HYDROCHLORIC ACID-SODIUM CHLORIDE-MAGNESIUM CHLORIDE MIXTURES AS CALCULATED FROM ELECTROMOTIVE FORCE MEASUREMENTS
Richard James Herdklotz, Jr. (Ph.D. Thesis Tenn. Univ., Knoxville) Jul. 1970 201 p
(Contract W-7405-eng-26)
(ORNL-TM-3017) Avail: NTIS

The behavior of the activity coefficient of each solute component in aqueous HCl-NaCl-MgCl2 mixtures was investigated. Activity coefficients were determined over a wide range of temperatures and concentrations from experimental measurements of the electromotive force of the cell. Good agreement was obtained between observed and calculated values. Additional neutral electrolyte interaction terms were determined using the least squares method. Values were computed as a function of temperature and total ionic strength. Plots demonstrate the concentration dependence of the activity coefficients of the solutes in aqueous HCl-NaCl-MgCl2, HCl-KCl-CaCl2, and HCl-CaCl-BaCl2 mixtures. Plots are also given for the temperature dependence of the mixtures. Author

N71-10823# Johns Hopkins Univ., Baltimore, Md. Medical Inst.
FIELD IONIZATION MASS SPECTRA OF PHOTOPOLYMERS OF THYMINE
C. Fenselau, S. Y. Wang, and P. Brown (Arizona State Univ.) [1970] 12 p refs Prepared in cooperation with Ariz. State Univ.
(Contract AT(30-1)-2798; Grants NSF GB-7866; NSF GP-6979; NIH G-M-16492; PHS-FR-4378)
(NYO-2798-50) Avail: NTIS

The field ionization mass spectra of cis-syn thymine dimer, thymine-thymine adduct, and a new thymine phototrimer were measured. Results are presented to illustrate that this technique is more efficacious than the electron impact method in structural elucidation of photopolymers of thymine and related compounds. Author

N71-10848# Admiralty Research Lab., Teddington(England).
SOME EXPERIMENTS IN ULTRAVIOLET PHOTOCHEMISTRY
M. J. Hurn May 1970 17 p
(AD-711277; ARL/H/N3; NSTIC-26925) Copyright Avail: NTIS CSCL 7/5

A device consisting of a special medium pressure mercury U/V lamp/reaction chamber/detector has been shown to provide a useful monitor of changes in sulphur dioxide concentration but the absolute levels of concentration which could be determined have not been established. The performance of the controlled low voltage lamp was examined for possible use as a fluorescence source since its low power requirement improved emission makes it superior to existing units. Author (TAB)

N71-10871# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TEMPERATURE EFFECTS ON THE LUMINESCENCE OF BENZOPHENONE IN POLYMERS
Peter F. Jones and A. Ray Calloway 1 Jul. 1970 13 p refs
(Contract F04701-70-C-0059)
(AD-711068; TR-0059(6250-20)-6; SAMSO-TR-70-282) Avail: NTIS CSCL 7/4

Using rigid polymer matrices, it was possible to confirm that benzophenone exhibits a delayed thermal fluorescence at 300K and have shown that the spectrum of this emission is an approximate mirror image of the structured singlet-singlet n,π^* absorption spectrum. Lifetimes of benzophenone in various polymers of styrene and its derivatives at 300K are compared with the previously reported lifetime in benzene. It was concluded that, if solvent-solute interactions are responsible for the anomalously short phosphorescence lifetime in benzene, then this interaction has a strong steric requirement. Author (TAB)

N71-10902# Farnham (Frank C.) Co., Philadelphia, Pa.
FUNDAMENTAL ASPECTS OF PLUTONIUM CHEMISTRY. 2: OXIDATION STATES OF THE ELEMENT [ASPECTOS FUNDAMENTALES DE'LA QUIMICA DEL PLUTONIO. 2: ESTADOS DE OXIDACION DEL ELEMENTO]
J. A. Perez-Bustamante 10 Jul. 1970 56 p refs Transl. into ENGLISH from Energia Nucl. (Madrid), v. 13, no. 57, 1969 p 23 45 In ENGLISH and SPANISH Prepared for Mound Lab.
(Contract AT 33-1-GEN-53)
(MLM-1747(TR)) Avail NTIS

Pu(III), Pu(IV), Pu(V), Pu(VI) coexist in solution. This is due to the small differences of redox potentials of different oxidation states in interconversion and the tendency towards disproportionation. Analytical and technical difficulties in obtaining any oxidation state in pure form are increased by the radioactivity of Pu, which as a strong alpha-emitter, exhibits radiolytic autoreduction, and by the tendency of Pu(IV) and Pu(VI) to form collodial solutions on hydrolysis. Pu atoms, linked by O or H bonds, may agglomerate to micelles containing up to 10 billion Pu atoms. The survey covers the unusual properties of metallic Pu and its recovery in pure form from irradiated U. Pu(II) which exists only in solid condition, and the recently discovered Pu(VII). Each oxidation state is discussed separately with emphasis on chemical and electrochemical methods of converting one into the other. Organic chelating agents for Pu are also considered. A diagram shows schematically the interconversion methods discussed. NSA

N71-10965# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
VAPORIZATION KINETICS OF ALUMINUM NITRIDE. ANALYSIS OF RESULTS OF KNUDSEN CELL NITROGEN EXCHANGE REACTION
Emile Rutner and Edmund J. Rolinski Jul. 1970 60 p refs Supersedes FML-TR-68-120; N6913886
(AD-711653; AFML-TR-68-120) Avail: NTIS CSCL 7/4

A model for the exchange of nitrogen isotopes taking place between two pellets of aluminum nitride in a Knudsen cell by means of gas-solid reactions was proposed, and the differential equations describing the kinetics of exchange in terms of vaporization, condensation, and flowrates were solved. Values of vaporization and condensation reaction rate constants were determined. It was also determined that the best fit to the data requires that reaction zone be defined to be equal to the thickness of 100,000 layers of atoms. The vaporization coefficients and condensation coefficient were found to be equal to each other. Author

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see 23 Physics, General; and 21 Navigation.

N71-10028# Communications Research Centre, Ottawa (Ontario).
A COHERENT LABORATORY RADAR SYSTEM
F. E. Smith Feb. 1970 29 p refs
(CRC-TN-628) Avail: NTIS

A coherent laboratory radar system is proposed for conducting studies on digital MTI subsystems subjected to real clutter environments. Fundamental design considerations for a coherent pulsed system are presented. In particular, the digital signal processing channel, the system dynamic range, the estimated clutter return levels, and the influence of system errors on the clutter cancellation ratio are discussed. Several systems extensions to incorporate such techniques as frequency agility, coded waveform design, electronic antenna scanning, and adaptive digital processing are introduced to indicate the growth potential of the proposed system. Author

N71-10029# Communications Research Centre, Ottawa (Ontario).
RECEPTION OF MULTIPLEXED SIGNALS OVER MULTIPLE CHANNEL AND DIVERSITY SYSTEMS
A. R. Kaye and D. A. George Mar. 1970 32 p refs
(CRC-1211) Avail: NTIS

The optimum receiver for pulse-amplitude-modulated (PAM) signals transmitted over a single channel consists of a cascade of continuous and transversal filters. It is shown that an extended structure of this type is also optimum for the completely general case of M multiplexed PAM signals transmitted over random time and frequency dispersive, multichannel systems with I inputs and N outputs, where each output is subjected to arbitrarily correlated additive noise. The random channels may also be arbitrarily correlated. In general, the receiver consists of MN continuous filters and M tapped delay lines with sq M sets of taps. An adaptive version is also described. Included as special cases are results for diversity systems, multi-input systems such as multipair cables and multiple terminal systems such as multiple access repeaters in which co-channel interference occurs. Author

N71-10148# Royal Radar Establishment, Malvern (England).
HIGH POWER RADAR FOR IONOSPHERIC RESEARCH
C. D. Watkins *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p ref (See N71-10126 01-34)
Copyright. Avail: NTIS

The UHF radar which has been used for Thompson scatter studies of the ionosphere is described. The parameters of the equipment are listed. F.O.S.

N71-10153# Royal Radar Establishment, Malvern (England).
A NEW PHASE-SENSITIVE RECTIFIER OF LARGE DYNAMIC RANGE
R. C. Bowes and E. F. Good *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

A symmetrical balancing circuit using complementary transistors and a floating power supply is discussed. A balancing principle is applied which in theory (assuming transistors of infinite current gain) gives perfect zero stability without matched components because orthogonality exists between the dc supply circuit and the output circuit. In practice, the circuit gives better zero stability than earlier long-tailed pair circuits with no greater circuit complexity or expense. E.C.

N71-10165# Royal Radar Establishment, Malvern (England).
ALTERNATIVE STATISTICS FOR RADAR TARGETS
E. S. J. Price *In its* RRE Newsletter and Res. Rev., No. 8 1969 5 p ref (See N71-10126 01-34)
Copyright. Avail: NTIS

Probability distributions for radar target characterization using non-Swerling target models are discussed as well as target echoing area characteristics effect on radar performance. Diagrams show cumulative echoing area probability distributions, their power density functions, and single pulse detection probabilities related to a steady target, all normalized with respect to their overall means. Rice power curves are derived from Scholefield's examples; a dumbbell target for two scatterers in random phase was derived from first principles. E.C.

N71-10219# Royal Radar Establishment, Malvern (England).
BEAM STEERING LOGIC FOR A TWO DIMENSIONAL ELECTRONICALLY SCANNED ARRAY RADAR
T. P. Pulford *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

The computer logic is described to work with an array of 49 × 49 matrix of 2401 modules arranged as a lens and each incorporating a two bit phase shifter. The pointing direction is defined by giving the incremental column phase shift and the incremental row phase shift. A typical row and column multiplier is illustrated, and the procedures are outlined. A maximum of eight integrated circuits is required. N.E.N.

N71-10226# Royal Radar Establishment, Malvern (England).
A HIGH POWER S BAND RADAR FOR METEOROLOGICAL STUDIES
K. A. Browning and C. D. Watkins *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p (See N71-10201 01-34)
Copyright. Avail: NTIS

Parameters and preliminary results are given for a circularly polarized 11 cm meteorological radar for detection of echoes from refractive index fluctuations in clear air. Parameters include: wavelength 10.7 cm; pulse length 1.3 microseconds; antenna gain 54 db; system noise temperature about 250 K; transmitter power 1 MW; pulse rate 800s sup -1; half power beamwidth 0.3 degrees; and receiver bandwidth 2 MHz. E.C.

N71-10227# Royal Radar Establishment, Malvern (England).
DIGITAL SPECTRUM ANALYSIS OF METEOROLOGICAL RADAR ECHOES
J. B. G. Roberts and D. C. A. Huntley *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Meteorological radar data reduction techniques and equipment are outlined. These include computer aided Fourier data transformation into the frequency domain, and power spectra data storage and display. E.C.

N71-10231# Royal Radar Establishment, Malvern (England).
MODULATED SUB-CARRIER SYSTEM FOR THE PRECISE MEASUREMENT OF ATTENUATION AT X BAND
F. L. Warner, P. Herman, M. C. Hopper, and T. Jeffs *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p (See N71-10201 01-34)
Copyright. Avail: NTIS

The modulated sub-carrier system described was developed to act as one of the British national standards for attenuation measurement at X band. This sytem is based upon a technique originated at the National Bureau of Standards in the USA. Several new features have been incorporated in this equipment to improve its performance, increase its dynamic range, and make it easier to use. Two extremely accurate 7-decade 1 kHz ratio transformers in tandem form the reference standard. Author

N71-10232# Royal Radar Establishment, Malvern (England).
AN INERTIALESS SCAN ARRAY
A. Maclese *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p (See N70-10201 01-34)
Copyright. Avail: NTIS

An experimental radar using an antenna array which can scan electronically in two planes, under computer control, has been built. In parallel with the experimental program, theoretical studies are being carried out of the radiation pattern characteristics of the array and the ways in which the beam positioning flexibility can be exploited in a system. The objective is to gain an appreciation of the design problems and the operational advantages of a radar system no longer limited to a data rate set by mechanical movement of the aerial. Author

N71-10233# Royal Radar Establishment, Malvern (England).
THE REDUCTION OF RADAR GLINT BY FREQUENCY AGILITY
D. Wooller *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

The use of variable microwave circuits to improve tracking accuracy is mentioned along with effects of glint on radar angular errors. Frequency agility techniques are cited. A theoretical model for predicting modified flint spectrum and a straightforward application to two frequency sampling are briefly discussed. E.C.

N71-10234# Royal Radar Establishment, Malvern (England).
ANALYSIS OF THE RADAR SIGNATURES OF ARTIFICIAL EARTH SATELLITES
I. A. D. Lewis *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p (See N71-10201 01-34)
Copyright. Avail: NTIS

Two methods of signature analysis for different types of objects are described. In both methods the sight-line directions are transformed from local coordinates into a fixed celestial frame of reference, and the parameters of the elliptical orbit are found. Bodies of revolution, such as spent rocket bodies and nose cones, have complex rotational motion which produces specular reflections, and a deductive analysis is carried out, spin axis, period, and precessional motion parameters can be determined. Attitude stabilized payloads produce more continuous signal records; since angular momentum is not conserved, dynamical analysis is not possible, and a trial and error approach is used. In this case dimensions of simple surfaces can be deduced from the specular reflections and peak echoing area. Simple models are postulated, leading to more complicated models. N.E.N.

N71-10255*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS SYSTEMS RESEARCH: TELECOMMUNICATIONS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 17 43 (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 17B

Research progress is reported on a digital phase-locked loop for a single channel command system, determination of the optimum modulation indexes and the corresponding maximum rate-to-bandwidth ratios for the interplex modem in space station unified communication, a phase tracking method for a two-channel, suppressed-carrier interplex system, and a simple sequence permuter for disguising speech. R.B.

N71-10256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS ELEMENTS RESEARCH: TELECOMMUNICATIONS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 44 47 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 17B

The potential efficiency of slotted lens antennas for spacecraft is compared to that of zone-plate lenses. Some slots are located on the planar surface such that the fields transmitted through the surface experience a phase shift, designed to convert the spherical phase front to a nearly planar phase front. In order to design a slotted lens, a practical slot size range of the admittance normalized to the characteristic admittance of the transmission line from minus to plus infinity must be determined. R.B.

N71-10257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT TELECOMMUNICATIONS SYSTEMS: TELECOMMUNICATIONS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 48 59 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 17B

A method is described for finding the power spectrum of a PN-coded square wave modulated with a square wave subcarrier of a frequency that is an integer multiple of the PN clocking frequency. The solution is used to analyze the power spectrum of a wave form used in a digital spacecraft command system. The effect of predemodulation filtering on the correlation and error signals in a pseudonoise receiver is also studied. R.B.

N71-10303# Naval Research Lab., Washington, D.C. Geophysics Branch.
A DUAL-PRF, DUAL-PULSE-LENGTH SYNCHRONIZER FOR

THE TWO-FREQUENCY RANDLE CLIFF RADAR Interim Report
Phillip L. Watkins 6 Jul. 1970 23 p ref
(AD-709902; NRL-7120) Avail: NTIS CSCL 17/9

The Randle Cliff Radar uses two radar systems, one operating at vhf and the other at uhf. These two radars are often operated concurrently so that data can be obtained on a target simultaneously at two frequencies. To permit simultaneous operation of the radars at different pulse repetition frequencies (prf) and different pulse lengths, a common synchronized timing system is required. This timing system, termed the radar synchronizer, provides the radars with properly timed triggers and gates for a variety of functions. This report describes the design and operation of the synchronizer which has been built and tested. It was installed in the radar system in October 1969 and consists of four rack-mounted units using solid-state discrete component and integrated circuitry. Simultaneous operation of the radars at different prfs and pulse lengths is provided, with the prfs synchronized. Author (TAB)

N71-10345# Harvard Univ., Cambridge, Mass. Cruft Lab.
EXPERIMENTAL STUDY OF ELECTRICALLY THICK MONOPOLE ANTENNAS. 1: EQUIPMENT, ADMITTANCES AND IMPEDANCES
Sandor Holly Dec. 1969 117 p refs
(Contract F19628-68-C-0030)
(AD-710213; AFCRL-70-0338(1); SR-8-Vol-1) Avail: NTIS CSCL 9/5

The purpose of this research was to investigate the behavior of electrically thick cylindrical antennas by obtaining experimental data on a physics counterpart of a theoretical dipole antenna model. The experimental apparatus, consisting of a monopole antenna driven over an image place by means of a coaxial line, was designed to allow for the measurement of antenna characteristics over a 0.1 or ka or 1.0 thickness range, where a is the antenna radius and k 2 pi/wavelength is the propagation constant. This is a thickness range for which all higher order coaxial modes are still below cutoff but, on the other hand, ka values are large enough that they are out the range of validity of linear antenna theory. Author (TAB)

N71-10346# Harvard Univ., Cambridge, Mass. Cruft Lab.
EXPERIMENTAL STUDY OF ELECTRICALLY THICK MONOPOLE ANTENNAS. 2: CURRENTS, CHARGES AND CONCLUSIONS
Sandor Holly Dec. 1969 110 p refs
(Contract F19628-68-C-0030)
(AD-710214; AFCRL-70-0338(2); SR-8-Vol-2) Avail: NTIS CSCL 9/5

For abstract see N70-46187.

N71-10394# National Aviation Facilities Experimental Center, Atlantic City, N.J.
STUDY OF THE PERFORMANCE CHARACTERISTICS OF THE BENDIX TYPE DRA-12 AIRBORNE DOPPLER RADAR SYSTEM Final Report, Feb. - Oct. 1970
Robert H. Mayer Nov. 1970 20 p refs
(FAA-NA-70-50; FAA-RD-70-73) Avail: NTIS

A study of the performance characteristics of the Bendix Radio type DRA-12 Doppler navigation system and the General Electric miniature heading and attitude system type A/A24G-26, for the purpose of determining the expected navigation error when flying straight and level, and the expected error as a result of making a standard rate turn at a speed of 200 knots, is reported. A profile of the error, while in straight and level flight, is presented to which each 180 deg turn error of 184 feet should be added in quadrature to obtain the expected error at any discrete distance from the Doppler reference point. The results of this study are considered useful in determining the extent to which Doppler navigation can be applied to the Sabreliner aircraft flight inspection mission. Author

N71-10422*# Translation Consultants, Ltd., Arlington, Va.
MULTIPLE MIRROR ANTENNA DESIGN FOR THE RT-22 FIAN RADIO TELESCOPE [MNOGOZERKAL'NAYA SKHEMA ANTENNY RADIOTELESKOPA RT-22 FIAN]
L. D. Bakhrakh et al. Washington NASA Oct. 1970 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorki), v. 12, no. 8, 1969 p 1109 - 1114
(Contract NASw-2038)
(NASA-TT-F-13330) Avail: NTIS CSCL 09E

The multiple mirror system for feeding the antenna of an RT-22 radio telescope, and the procedure used to tune it, are reviewed. A central radiator, and two side radiators, were installed on the antenna for observations on a wavelength of 8.2 mm, as was a central radiator for investigations on a wavelength of 3.34 cm. The principal electrical parameters of the system are given. Author

N71-10471# Lehigh Univ., Bethlehem, Pa. Dept. of Electrical Engineering.
AUTOMATIC EQUALIZATION FOR DATA COMMUNICATIONS
Laveen Kanal Dec. 1969 37 p refs
(Grant AF-AFOSR-1390-68)
(AD-710646; AFOSR-70-2236TR) Avail: NTIS CSCL 17/2

The paper examines the problems encountered and the approaches followed in using telephone lines for high-speed data transmission. Factors which limit high-speed data transmission on telephone lines are described, and a discussion of unspecified channel impairments such as phase jitter, non-linear distortion, impulse noise is presented; multi-level signaling is explained. Adaptive and Preset Equalizers are considered and algorithms for the adjustment of tapped-delay-line filters to minimize distortion due to intersymbol interference and noise are surveyed. The optimum statistical solution to the detection of the received symbols is contrasted with the linear solution represented by the adjustable tapped-delay-line equalizer. The paper sets the stage for future reports on this topic under this grant. Author (TAB)

N71-10474# Technische Hogeschool, Eindhoven (Netherlands).
FREQUENCY-INDEPENDENCE AND SYMMETRY PROPERTIES OF CORRUGATED CONICAL HORN ANTENNAS WITH SMALL FLARE ANGLES
Martinus Elisabeth Johannes Jeuken (Ph.D. Thesis) 8 Sep. 1970 148 p refs
Avail: NTIS

The parabolic reflector is used as an antenna for radar, line-of-sight communications, satellite communications and as an instrument for radio-astronomical investigations. The principle of this reflector antenna is that a spherical wave departs from the focal point of the parabola towards the reflector, which reflects the wave and concentrates a large part of the energy in a small angle along the axis of the parabola. As a source of the spherical waves use is mostly made of a small horn antenna. Such a source is called a feed. It is obvious that the performance of the reflector antenna depends mainly on the feed used. The precise requirements which have to be satisfied by the feed depend on the application for which the antenna will be used. Summarized are the most relevant properties of the feed in the four applications mentioned. Author

N71-10535# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF A PSEUDO-NOISE ADDRESSING SYSTEM FOR MULTIPLE ACCESS COMMUNICATION WITH APPLICATIONS OF ERROR-CORRECTING CODES

Oscar M. Bull (M.S. Thesis) (Chilean Navy) Jun. 1970 88 p refs
(AD-711001) Avail: NTIS CSCL 9/4

The thesis describes several modulation schemes to be used in a random access discrete address (RADA) system. This RADA system uses only one common frequency as carrier, and no synchronization of the net is supposed. Recognition of the transmissions between pairs of talkers involves the use of pseudo-random sequences as individual addresses of each subscriber. Detection of a particular pseudo-random sequence, contaminated by the noise formed by the simultaneous transmissions of other sequences, is accomplished by correlation methods. A comparative study is presented for the transmission of the information by the RADA system. The following methods are described and analyzed: an M-ary system, where the information is represented by cyclic shifts of the pseudo-random sequence used as the recipients address, and pulse code modulation (PCM) where the information is represented by a 1 or 0. Finally, the effect of encoding the information digits via error-correcting codes is investigated. Here, use of cyclic block codes and convolutional codes are presented. It is concluded that the use of convolutional codes would improve the performance of RADA systems. Author (TAB)

N71-10567# Army Electronics Command, Fort Monmouth, N.J.
AN INFORMATION FEEDBACK APPROACH APPLIED TO AN AMPLITUDE-MODULATED DIGITAL LASER COMMUNICATIONS SYSTEM
Larry U. Dworkin Mar. 1970 98 p refs
(AD-710946; ECOM-3258) Avail: NTIS CSCL 17/2

The use of predecision feedback in a laser communication system employing an amplitude-modulated laser transmitter and photomultiplier receiver is considered. Poisson statistics are used to describe the distribution of emitted photo electrons in a fixed time interval from the photo emissive surface of the receiver when the incident field is a mixture of a single mode laser and broadband thermal noise. The use of a noiseless feedback path to reduce the variance of the received photo electron count is examined. A technique known as feedback averaging is conceived and the following properties are demonstrated. (a) The variance of the received photo electron counts is significantly reduced over that obtained in a system without feedback. (b) The effects of background radiation and shot noise at the receiver can be reduced. (c) The effect of slow fading on the mean arrival rate of photons is reduced. This is achieved in the above system with the same average power and only slightly more peak power, in most cases, than the same system without feedback. The approach is treated analytically, and simulated on a digital computer. Author (TAB)

N71-10696# Environmental Science Services Administration, Boulder, Colo. Wave Propagation Lab.
ATMOSPHERIC ATTENUATION AT 15, 31, AND 53 GHz
J. B. Snider and Ed. R. Westwater Dec. 1969 87 p refs
(ESSA-TR-ERL-156-WPL-11) Avail: SOD $0.75

Atmospheric attenuation and sky emission measurements at 15, 31, and 53 GHz are described. Theoretical values of atmospheric absorption and brightness temperatures calculated from radiosonde data are compared with the near-simultaneous experimental measurements. It is concluded that the present theory of gaseous absorption gives estimates of attenuation that are sufficiently accurate for telecommunications design purposes. Attenuation in clouds requires additional study before optimum use of the higher frequencies can be achieved. Author

N71-10809* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ENDLESS TAPE TRANSPORT MECHANISM Patent
Kenneth W. Stark, inventor (to NASA) Issued 28 Mar. 1967 (Filed 29 Oct. 1963) 7 p Cl. 242-55.19
(NASA-Case-XGS-01223; US-Patent-3,311,315; US-Patent-Appl-SN-319892) Avail: US Patent Office CSCL 14C

A tape transport mechanism for driving and tensioning the recording medium in a magnetic tape recorder is described. An endless-loop tape cartridge is mounted on a lightweight supporting plate and a tape transport mechanism is mounted in the upper region of the plate not occupied by the cartridge. The tape cartridge consists of a circular tape reel with a spirally coiled tape pack. The lower edges of the tape pack rest on a group of tape support rollers mounted at intervals around a stationary ring. Dual capstans are mounted in the annular region of the support plate on opposite sides of the magnetic record-playback and erase heads to provide constant speed and stability of operation. R.B.

N71-10824# Institute for Telecommunications Sciences, Boulder, Colo.
AMPLITUDE AND TIME STATISTICS OF ATMOSPHERIC AND MAN-MADE RADIO NOISE
R. T. Disney and A. D. Spaulding Feb. 1970 124 p refs
(ESSA-TR-ERL-150-ITS-98) Avail: SOD $1.25

Some characteristics of atmospheric and man-made radio noise are discussed, principally with respect to recent measurements. Some recent results on the extension of the Hall model for impulsive phenomena to applications involving HF atmospheric noise and man-made radio noise are included. Author

N71-10854*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ATS-5 MILLIMETER WAVE EXPERIMENT DATA REPORT, JANUARY - AUGUST 1970, VOLUME 2
Louis J. Ippolito Oct. 1970 54 p refs
(NASA-TM-X-65371; X-751-70-389-Vol-2) Avail: NTIS, CSCL 20N

The ATS-5 experiment, launched August 12, 1969, is providing the first propagation data from an orbiting geosynchronous spacecraft in the 15 GHz (downlink) and 32 GHz (uplink) frequency bands. Updated are measurements reported in the first data report and provided are the first results of high rainfall measurements at the NASA Rosman station. Correlation of measured attenuation with ground measured rainfall rate was low for a single gauge but improved significantly with height averaging of 10 gauges. Correlation of measured attenuation with sky temperature recorded on a small aperture radiometer was very good for most storms. Valid predictions of attenuation from 16 GHz sky temperature measurements were observed for up to 15 db of measured attenuation. The uplink to downlink attenuation ratio varied with each precipitation event and often varied during a single storm. Author

N71-10863# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
STATISTICAL THEORY FOR THE DETECTION OF SIGNALS UNDER LINEAR SCALE TRANSFORMATIONS
Gibb Blanks Matlock (Ph.D. Thesis) 20 Apr. 1970 53 p refs
(Contract N00014-68-A-0515)
(AD-711112; TR-68) Avail: NTIS CSCL 9/4

Most of the literature of signal detection assumes a parametric signal model of the form f(t) beta S(t - t sub 0) where the amplitude beta and the time of arrival t sub 0 are unknown. Many of the questions remain unanswered about signals of the form beta S(at - t sub 0) where a is an unknown scale parameter. Several basic results are presented about the reception of signals of this more general form. The likelihood Ratio Test for detection is developed and curves of probability of detection as a function of signal-to-noise ratio are given for various false alarm rates. Detection in the case of multiple observations is also considered. Estimation of the unknown signal parameters beta, a, t sub 0 and the

unknown noise variance Sigma squared is treated. The maximum likelihood or least squares estimators for these parameters are given, along with an iterative computational technique. The large sample distribution of the estimators is also given. Two types of signal classification problems are discussed and the Bayes decision rules for their solutions are presented. Author (TAB)

N71-10665# Technology, Inc., Dayton, Ohio.
ANALYSIS OF DATA DENSITY AND STORAGE REQUIREMENTS FOR HIGH RESOLUTION RADAR SIMULATION SYSTEM DESIGN Final Report, Feb. 1969 Feb. 1970
Patrick D. Fligor Wright-Patterson AFB, Ohio AFHRL Jun. 1970 144 p refs
(Contract F33615-69-C-1363)
(AD-711385; AFHRL-TR-70-12) Avail: NTIS CSCL 17/9

The state-of-the-art was sampled to determine whether modern, commercially available computers with mass data storage units offered the potential for simulation of the performance of high-resolution radar systems. This effort was primarily concerned with the data storage for urban areas since such areas would place the severest burden upon the digital storage and computation system. Selected areas of New York City and San Francisco were analyzed from aerial photographs, and 74,000 dimensional readings were taken to form the basis for the conclusions given in this report. The analysis of results based upon extrapolations indicated the feasibility of system simulation from the standpoint of data storage and access time of modern computers. Author (TAB)

N71-10676* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL WAVEGUIDE MODE SOURCE HAVING CONTROL MEANS FOR ADJUSTING THE RELATIVE AMPLITUDE OF TWO MODES Patent
Arthur C. Ludwig, inventor (to NASA) Issued 6 Jun. 1967 (Filed 29 Dec. 1964) 5 p Cl. 333-21 Sponsored by NASA
(NASA-Case-XNP-03134; US-Patent-3,324,423; US-Patent-Appl-SN-422095) Avail: US Patent Office CSCL 17B

A waveguide mode generator is described in which a discontinuity is present so that a dominant mode supplied to the generator is excited to generate higher order modes. The dimensions of the generator are selected to insure that the desired higher order mode is generated from the input energy. The generator also includes a control element which is selectively positionable within the waveguide mode generator so that the power of the dominant mode used as the input energy may be controlled with respect to the power of the higher order mode. R.B.

N71-10694# Army Electronics Command, Fort Monmouth, N.J.
AN INFORMATION FEEDBACK APPROACH APPLIED TO POLARIZATION-MODULATED LASER COMMUNICATION SYSTEMS
Larry U. Dworkin Jul. 1970 27 p refs
(AD-710955; ECOM-3314) Avail: NTIS CSCL 17/2

The use of an information feedback procedure, called Feedback Averaging is applied to an M-ary Polarization Modulated Laser Communication System. The systems with and without feedback, that are limited by photon fluctuation, are considered and compared. A significant improvement in error rate of a system with feedback is demonstrated over a one-way system for a quaternary system subject to intensity constraint. Author (TAB)

N71-10696*# TRE, Inc., Rockville, Md.
ADVANCED HIGH EFFICIENCY TRANSMITTER (ENGINNERING MODEL) Final Report
[1970] 125 p
(Contract NAS1-9283)
(NASA-CR-111789) Avail: NTIS CSCL 17B

The design, development, and fabrication of advanced 30 watt, high efficiency engineering prototype FM transmitter in the frequency range of 400 to 450 MHz by utilizing phase-lock techniques are described. The transmitter was to be used in a Mars probe landing for data transmissions from ground station to orbiter. The unit produces 30 watts at an efficiency of 34% at 401.5 MHz in the frequency shift keying mode of operation. The total dc input power required at a B+ of 28 volts dc is 90 watts. The unit was designed for as much redundance as possible. All rf spurious were > 65 db down from the carrier in the frequency range of dc to 1250 MHz. A summary of electrical results of the engineering prototype FSK transmitter is presented. Author

N71-10701# Illinois Univ., Urbana. Dept. of Electrical Engineering.
LINEARLY POLARIZED ARRAYS WITH ALMOST ISOTROPIC RADIATION PATTERNS
H. S. Cabayan and G. A. Deschamps Jun. 1970 46 p refs Prepared for Lincoln Lab., MIT
(Contract AF 19(628)-5167; Grant NSF GK-2120)
(AD-711075; Rept-70-10; ESD-TR-70-195) Avail: NTIS CSCL 9/5

A linearly polarized antenna cannot radiate power uniformly in all directions. However, by controlling the aperture excitation, as is done in an array, it is possible to reduce the maximum gain and approach conditions for isotropic radiation. A numerical method is presented which generates a family of designs which depend on a parameter alpha. As alpha approaches zero, the radiation pattern tends to become more isotropic. However, the efficiency is reduced and the sensitivity of the pattern to errors in the aperture function is increased. In some cases this sensitivity is so high as to make the result worthless. The design, therefore, must be a compromise between closeness to conditions of isotropic radiation on one hand, and losses and sensitivity to errors on the other. The sensitivity to errors, expressed by the pattern deterioration for a given level of error, has been evaluated by a numerical experiment (Monte Carlo method). A general relation has also been established between the sensitivity and the losses in the antenna. It agrees with the numerical experiment and can be used as a guide to choose the regularization parameter alpha. Author (TAB)

N71-10733# Stanford Univ., Calif. Electronics Lab.
THE EFFECT OF POLARIZATION ROTATION ON THE AMPLITUDE OF IONOSPHERICALLY PROPAGATED SEA BACKSCATTER
J. R. Barnum Jun. 1970 189 p refs
(Contract Nonr-225(64); ARPA Order 196)
(AD-711341; SU-SEL-70-036; TR-157) Avail: NTIS CSCL 20/14

Previous experiments have shown that an ocean surface represents a strong source of high-frequency (HF) backscatter. The author has used a 2.5 km receiving antenna array--the worlds largest--to study such backscatter both from the Gulf of Mexico and the Pacific Ocean. The narrow beamwidth of this antenna (1/3 deg average), together with SFCW sounding, confer unusually good azimuth and time-delay (range) resolution. The resulting detail and clarity has made possible more precise quantitative studies of sea backscatter. A particular goal of these studies is to develop a method of locating storms, or areas of unusual calm. Author (TAB)

N71-10743# RAND Corp., Santa Monica, Calif.
SHARING THE UHF BETWEEN SPACE AND TERRESTRIAL SERVICES
John L. Hult Sep. 1970 8 p refs Presented at the Proc. of The Natl. Electron. Conf., Chicago, 7-9 Dec. 1970
(AD-711499; P-4438) Avail: NTIS CSCL 17/2.1

The UHF is the choice portion of the spectrum for these satellite relay services from the standpoints of both the satellite relay performance and the total systems costs (the latter being dominated by the total costs of the many small earth terminals). It appears to be entirely feasible for the UHF to provide double duty with its complete sharing reuse for the new highest quality space services, without hindering the current terrestrial services or limiting their future development. The most difficult case of the sharing between the two types of TV broadcast service was examined in detail, and although there are many unknowns remaining, it appears that sharing will be feasible with adequate margins using earth terminals with as small receiving antennas as 1-sqm effective area. Author (TAB)

N71-10770# Air Force Cambridge Research Labs., Bedford, Mass.
A FIRST-ORDER PREDICTION MODEL OF TOTAL-ELECTRON-CONTENT GROUP PATH DELAY FOR A MIDLATITUDE IONOSPHERE
John A. Klobuchar and Richard S. Allen 8 Jul. 1970 28 p refs *Its* AFCRL-AFSIG-222
(AD-711365; AFCRL-70-0403) Avail: NTIS CSCL 4/1

An ionospheric total-electron-content prediction model has been developed at AFCRL for use in correcting range errors encountered by operational UHF radar systems and the proposed L-band 621B multisatellite position-fixing system. These system range errors are due to the excess time delay encountered as the radio wave passes through the earths ionosphere, and are proportional to the total number of electrons through which the wave must pass on its way from transmitter to target. In response to a request by SAMSO, a model was developed by AFCRL in which the range error due to the ionosphere can be expressed in terms of the critical frequency of the ionosphere, f sub o F sub 2, a parameter that is currently predicted on a worldwide basis for military users by the Air Weather Service. Using total-electron-content data taken at the AFCRL Sagamore Hill Radio Observatory, an analytic model was constructed. It was tested against other data available from member countries in the Joint Satellite Studies Group, an informal affiliation of scientific groups from several countries who are studying ionospheric parameters using satellite beacon signals. Tests of the model using actual f sub o F sub 2 data show a smaller rms error than the use of monthly median values of the original total electron content data would have given. Author (TAB)

N71-10775* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTIPLE INPUT RADIO RECEIVER Patent
James H. Schrader, inventor (to NASA) Issued 28 Mar. 1967 (Filed 29 Mar. 1963) 6 p Cl. 325-305
(NASA Case-XLA-00901; US-Patent-3,311,832; US-Patent-Appl-SN-269212) Avail: US Patent Office CSCL 17B

A radio receiver is described which operates from an array of independently steerable antennas for deep space communications, and is capable of performing to the same threshold as a phase lock receiver operating from a single antenna with an effective aperture equal to the sum of the effective apertures in the array. The receiver detects the average amplitude, phase and frequency of the RF signals received on all the antennas in the array. F.O.S.

N71-10800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENGINEERING-ECONOMIC ANALYSIS OF THE TDRS KU-BAND GROUND ANTENNA SYSTEM
Andrew J. Rolinski Sep. 1970 124 p refs
(NASA-TM-X-65370; X-525-70-343) Avail: NTIS CSCL 17B

Systems analyses of single dish, quad-array, and multiple-aperture ground station antenna designs and cost-effectiveness values established that: (1) the limiting factor in the process of detecting electromagnetic energy is thermal noise. Thus, noise temperature of the system is a critical system parameter; (2) weather conditions adversely affect antenna performance at Ku-band; (3) for a given operating frequency, the reflector surface tolerance limits the gain of the antenna. For the cost model developed, decreasing the tolerance, increases the costs of the antenna in an exponential manner. (4) radomes are considered poor choices from the cost effectiveness viewpoint. (5) for a system gain requirement of 70 db, the preferred cost effectiveness antenna is the quad-array (QA). (6) for a system gain requirement of 68.5 db, the best cost-benefit station is the single dish (SD) station. Since the costs related to operation and equipment replacement are significant weighting factors in the cost benefit study, the array systems do not compare as favorably as the SD system in this analysis. Author

N71-10822# Joint Publications Research Service, Washington, D.C.
WAVE CHANNEL TYPE ANTENNA WITH MODULATED PHASE VELOCITY
O. N. Tereshin et al 27 Oct. 1970 8 p refs Transl. into ENGLISH from Radiotekhnika (Moscow), no. 8, 1970 p 39-43
(JPRS-51649) Avail: NTIS

The possibility of building axial radiation dipole antennas with modulated phase velocity employing the laws of phase velocity modulation obtained for a two dimensional contour impedance structure is demonstrated. The synthesis method used gave good correspondence between calculated figures and those obtained from experimentally synthesized antenna directional diagrams. J.M.

N71-10858# Army Electronics Command, Forth Monmouth, N.J.
A THIN FILM FACSIMILE SCANNER
George E. Brown and Wilfred H. Hell Jun. 1970 14 p
(AD-710953; ECOM-3308) Avail: NTIS CSCL 17/2

An electronic photoconductor scanner for image sensing is described which operates in direct contact with the page, thereby securing a high degree of compactness. Integral with the sensors is a light source and various transistor circuits which cause each of the photoconductors to be interrogated sequentially along the length of the array. The interrogation mechanism is a shift register which propagates a logical one digit along its length in synchronism with a clock. As this bit steps past a photoconductor, it causes the electrical output of the photoconductor to be shaped and gated onto a common output bus. The series of pulses so produced represent the state of illumination at the surface of the paper on to the photoconductors. A resolution of 100 lines per inch with seven shades of gray has been experimentally achieved at a high signal to noise ratio. Author (TAB)

N71-10874# Army Electronics Command, Fort Monmouth, N.J.
AN EXPERIMENTAL FEEDBACK AVERAGING LASER COMMUNICATIONS SYSTEM
Larry U. Dworkin Jul. 1970 25 p refs
(AD-710956; ECOM-3315) Avail: NTIS CSCL 17/2

An experimental version of a feedback averaging amplitude modulated laser communications system is discussed. The ability of the system to reduce the variance of photon arrivals is demonstrated experimentally. Properties of a receiver estimator calculated in previously published reports are verified. Author (TAB)

N71-10889# Army Electronics Command, Fort Monmouth, N.J.
CUTANEOUS COMMUNICATIONS Final Report, 1966-1969
John M. McCray Jun. 1970 175 p refs
(AD-710949; ECOM-3303) Avail: NTIS CSCL 17/2

Cutaneous communications is a new method of communications which could meet certain needs of the Army which

are not satisfactorily met by other forms of communications. Previous methods of communication have depended on the aural or visual senses. These methods are not always appropriate. Under some conditions the cutaneous method can be used to strengthen or enhance present forms of communication or can be used as a channel on its own merit. The report describes the experiments conducted during a program of study designed to test the feasibility of this form of communication and to investigate methods by which this communication could be achieved most effectively with minimum power requirements. Author (TAB)

N71-10898# Institute of Electrical and Electronics Engineers, New York.
INTERNATIONAL SYMPOSIUM, 1970, ON INFORMATION THEORY: PROGRAM AND ABSTRACTS OF PAPERS Final Report
1970 100 p Conf. held at Noordwijk, Neth., 15 - 19 Jun. 1970; sponsored by IEEE and Union Radio Sci. Intern.; also supported in part by Neth. Postal and Telecommun. Serv.
(Contract F44620-70-C-0065)
(AD-711434; AFOSR-70-2318TR) Avail: NTIS CSCL 9/4

The report summarizes the highlights of the 1970 International Symposium on Information Theory, held from June 15-19, 1970, Noordwijk, The Netherlands. Author (TAB)

N71-10951# National Committee for Space Research, Haifa (Israel). Radio Observatory.
IONOSPHERIC RESEARCH USING SATELLITES Annual Scientific Report, 1 Feb. 1969 - 31 Jan. 1970
J. Mass and Z. Houmier 28 Feb. 1970 22 p refs
Contract F61052-69-C-0017)
(AD-711403; AFCRL-70-0427) Avail: NTIS CSCL 20/14

An attempt was made to measure the total polarization rotation at the transverse region. The measured polarization rotation did not follow the simple expected curve predicted by theory. It was found-out that the sense of rotation reverses direction at the transverse region and then changes back rather abruptly. This phenomenon of sense reversal was unexpected and attempts to explain this behaviour have failed so far. Amplitude recordings of the 136 MHz transmissions of the Canary Bird synchronous satellite were analysed for scintillations for the periods December 1967 - January 1968 and April - May 1968. Diurnal variations and probability distributions of amplitude scintillations for these periods are presented. Author (TAB)

N71-10969# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOTION PICTURE AND TELEVISION ENGINEERING, VOLUME 13, NO. 12
V. P. Azovtsev et al 29 Jul. 1970 44 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 13, no. 12, 1969 p 39 - 51
(AD-711748; FTD-HT-23-275-70) Avail: NTIS CSCL 17/2

Contents: Principles of controlling the surface deformations of light-modulating layers; The influence of the frequency characteristic of an aperture corrector on the signal-to-noise ratio; The LI-420 vidicon with electrostatic focusing and beam deflection; Increasing the resolving power of a television converter-scanistor. TAB

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N71-10014# Hawaii Univ., Honolulu.
THREADING FOR ENCODER TRAVERSAL Interim Report
Fred M. Tonge Apr. 1970 38 p refs
(Contract F44620-69-C-0030; Proj. THEMIS)
(AD-709231; THEMIS-A70-6; AFOSR-70-1942 TR) Avail: NTIS CSCL 9/2

Several approaches are presented to threading a tree for encoder traversal. These approaches use additional fields in each node of the tree, additional nodes, or a more typical threading philosophy but requiring additional processing to locate the thread associated with a node. For each approach, a traversal algorithm is given. For the latter approach, a proof of the algorithm is developed. All algorithms are analyzed in terms of number of executions of each step and in terms of running time for an IBM 360/50 implementation. The approaches are compared with respect to space, time, and generality. Author (TAB)

N71-10015# Electrotechnical Lab., Tokyo (Japan).
AUTOMATIC LANGUAGE PROCESSING SYSTEM: NATURAL LANGUAGE DICTIONARY FOR MACHINE TRANSLATION
Yoshiyuki Sakamoto Mar. 1970 144 p refs *Its* Res. No. 707
Avail: NTIS

The development of a natural language dictionary for machine translation in an automatic language processing system is described. The system uses digital computers for data processing and translation. The advantages and limitations of a machine translator, the problems of normalization in semantical evaluation of the translated text, and a comparison between man-translation and machine-translation are discussed. Author

N71-10016# Electrotechnical Lab., Tokyo (Japan).
THE DEVELOPMENT OF A MACHINE TRANSLATION SYSTEM
Hirohiko Nisimura Jan. 1970 133 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 705
Avail: NTIS

The development of a syntax directed translation system is discussed. The design philosophy involves stratification theory, phrase structure grammar, finite state grammar, and transformational grammar. The data processor is coded in COBOL in a compact form. It includes only COBOL functions which can be understood in the same way by several compilers and is thus compatible with different computers. Descriptions of the organization and operation of the computer are presented. Author

N71-10035# Communications Research Centre, Ottawa (Ontario).
COMPUTER GRAPHIC TERMINAL USING A STORAGE CRT
W. W. Nelson Nov. 1969 24 p
(CRC-TN-623) Avail: NTIS

The terminal uses a Tektronix 611 Bistable storage oscilloscope and is used with a Honeywell DDP-516 computer. The character generator uses hardware character generation to form characters made of 5 - 7 dot matrices. A two-speed clock is used, where the clock normally runs fast but is slowed down when dots are written, which greatly increases the writing rate. This feature gives the terminal an average writing rate of 620 microseconds per character. The terminal is capable of displaying in three modes: non-store, store, and write-through. The write-through-mode has the capability of writing over previously stored information without affecting the stored information. Eight programmable character sizes are available with the smallest character able to store 72 characters 72 lines or 5184 characters. Author

N71-10061# RAND Corp., Santa Monica, Calif.
EXTENSIONS TO THE PL/I LANGUAGE FOR INTERACTIVE COMPUTER GRAPHICS
R. N. Anderson and D. J. Farber Jan. 1970 22 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-709905; RM-6028-ARPA) Avail: NTIS CSCL 9/2

The report presents a proposed combination of the IBM Conversational Programming System (CPS) and the Rand Programmer-Oriented Graphics Operation (POGO). CPS is entirely typewriter oriented and uses a subset of PL/I with the ON-conditions and complete file I/O that are necessary in building an interactive graphical language. The facilities of POGO, which allow the user to draw on a screen the objects he wishes displayed, to label and name objects, and to define where to display appropriate items, are provided by these extensions to the language: (1) one new statement, DISPLAY, signalling the creation of a named display page; (2) additional options in the PUT and GET statements; and (3) an additional ON-condition, PUSH, that relates light-pen actions to asynchronous program responses. Author (TAB)

N71-10145# Royal Radar Establishment, Malvern (England).
SYNTAX ANALYSER GENERATION
Susan G. Bond and H. R. Simpson *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Syntax analysis is considered as a technique employed in computer programs required to respond to input data in a way which is dependent on the data structure. The SID program is discussed with revisions for application by other computers. F.O.S.

N71-10146# Royal Radar Establishment, Malvern (England).
SYNTAX TECHNIQUES IN DATA RETRIEVAL
P. W. Edwards and A. J. Fox *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-10126 01-34)
Copyright. Avail: NTIS

An experimental data retrieval system is described which makes extensive use of syntax techniques. The syntax of the query language CLIC (Command Language for Interrogating Computers) is discussed, and examples of CLIC commands are given. It is concluded that syntax techniques simplify program writing and enable good command languages to be implemented easily. F.O.S.

N71-10147# Royal Radar Establishment, Malvern (England).
INSERTION AND RETRIEVAL OF FACTS THROUGH AN ON-LINE COMPUTER TERMINAL
P. M. Woodward *In its* RRE Newsletter and Res. Rev., No. 8 1969 1 p (See N71-10126 01-34)
Copyright. Avail: NTIS

A computer program is described which enables data to be typed into the ICL 1902 computer using an on-line interrogating typewriter. The program catalogues sentences under nouns and knows sentences under nouns, by syntactic context. If the noun has never been used previously, it questions the user. It is concluded that the system is only a research tool, until conversational programs with access to on-line discs become economically practical. F.O.S.

N71-10167# Federal Aviation Administration, Washington, D.C.
DATA FILE EDITING AND PRELIMINARY ANALYSIS, CLEVELAND-HOPKINS AIRPORT ACCESS STUDY
May 1970 179 p
Avail: NTIS

A survey is presented on types of transportation used to reach the Cleveland Hopkins Airport before and after the construction of direct rapid rail transit service. The factors influencing the demand for rapid rail transit to airports were determined. J.A.M.

N71-10200# Naval Research Lab., Washington, D.C. Satellite Communication Branch.
THE NRL MICROWAVE SPACE RESEARCH FACILITY: COMPUTER SYSTEM HARDWARE FOR DATA ACQUISITION AND CONTROL OF THE 60 FT X-BAND ANTENNA Final Report
C. A. Bass and C. J. Stillings 15 Jun. 1970 62 p refs
(AD-709899; NRL-7103) Avail: NTIS CSCL 9/2

To provide precise control of the fully steerable, 60-ft X-band antenna at the Naval Research Laboratory (NRL) Waldorf Microwave Space Research Facility (MSRF), a computer-oriented control system has been developed to control pointing of the antenna. The system has provisions for real-time data acquisition and processing for the control of experiments as well as for the display of antenna-related information such as antenna position, tracking object range, object look angles, and doppler frequency shift. Control equipment has been developed by NRL to provide the interface between the antenna system and the associated Control Data Corporation 924A general-purpose digital computer system. All control actions of the real-time system interface with the computer are transmitted to the desired equipment through logic circuits in the interface system. The computer system has been provided with a unique logic system for data acquisition and display. This capability allows the computer to acquire and convert analog data to digital form in real time via the interface system so that real-time processing may be used to modify experimental parameters. Alternatively, the acquired digital data may be stored for later processing in other computer systems. Author (TAB)

N71-10224# Royal Radar Establishment, Malvern (England).
AN ACTIVE STORE WITH LIST PROCESSING CAPABILITY
J. F. Sherlock and J. T. Christie *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p (See N71-10201 01-34)
Copyright. Avail: NTIS

An active store is being designed which is capable of performing certain list processing operations as single machine instructions. These instructions, which are based on the procedures available within RREAC ALGOL, are CONS, HEAD, TAIL, SET HEAD, SET TAIL and SET GARBAGE MARKER. Unwanted list items can be cleared by a SET HEAD instruction after SET GARBAGE MARKER and the appropriate number of trace steps. The store is designed to allow all unwanted list items to be cleared simultaneously. It also enables sequences of list operations to be performed automatically without reference, for example, to the store addresses generated during CONS and TAIL instructions. Author

N71-10264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT DATA SYSTEMS: ASTRIONICS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 119-124 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 09B

An investigation of the characteristics of magnetic recording tape and the tape-to-head interface in the spacecraft environment is discussed. The design of a linear m-ary feedback shift register (FSR) is considered. It is shown that such a register can be decomposed into parallel linear p-ary FSRs where each p is a distinct prime factor of the integer m. An initial state of a linear m-ary FSR is shown to be on a cycle whose length divides the least-common multiple of the periods of p-ary FSRs with corresponding initial states. R.B.

N71-10283*# Bell Aerospace Co., Buffalo, N.Y.
FINAL FLIGHT CONTROL SOFTWARE PACKAGE FOR DIGITAL FLIGHT CONTROL AND LANDING SYSTEM
May 1970 36 p
(Contract NAS12-2074)

(NASA-CR-110905; Rept-6200-933011) Avail: NTIS CSCL 09B

The software required to mechanize the flight control system on an airborne computer is described. The majority of the description is presented in the form of detailed engineering equations and functional block diagrams and only those functions that are peculiar to the digital nature of the system are presented in the form of digital flow diagrams and logic equations. Author

N71-10284*# Bell Aerospace Co., Buffalo, N.Y.
FINAL GUIDANCE SOFTWARE PACKAGE FOR DIGITAL FLIGHT CONTROL AND LANDING SYSTEM
May 1970 32 p
(Contract NAS12-2074)
(NASA-CR-111025; Rept-6200-933012) Avail: NTIS CSCL 09B

The software required to mechanize the guidance system on an airborne digital computer is described. The majority of the description is presented in the form of detailed engineering equations and functional block diagrams and only those functions that are peculiar to the digital nature of the system are presented in the form of digital flow diagrams and logic equations. Author

N71-10371# Regional Planning Commission, Cleveland, Ohio.
DATA FILE FORMATS AND CODE DESCRIPTIONS: CLEVELAND HOPKINS AIRPORT ACCESS STUDY
Jun. 1970 94 p Sponsored by Dept. of Transportation
Avail: NTIS

The file formats and code descriptions are presented for the analysis of transportation to and from the airport before and after a direct rail rapid transit was provided from the central business district. Air passenger, airport employee, and casual visitor survey forms, and parking lot and rapid transit interview sheets are included. N.E.N.

N71-10377*# System Development Corp., Santa Monica, Calif.
ON THE EXISTENCE OF GENERATORS FOR CERTAIN AFL
Seymour Ginsburg (Univ. of Southern Calif., Los Angeles) and Gene F. Rose (Case Western Reserve Univ.) 18 Feb. 1970 32 p refs Prepared for AFCRL and AFOSR
(Grants NGR-30-027-001; NSF GJ-454; AF-AFOSR-1203-67A; Contract F19628-70-C-0023)
(NASA-CR-111110; AD-708494; TM-738/058/00; Scientific-5; AFCRL-70-0357) Avail: NTIS CSCL 09B

It is shown that under mild conditions on a tape function f, the AFL generated by the languages accepted by f-tape-bounded (deterministic) Turing acceptors is generated by a single language, i.e., is principal. The same result holds for the AFL generated by the languages accepted by f-tape-bounded Turing acceptors with a (possibly unbounded) pushdown tape. From these results it follows that the AFL generated by writing pushdown-acceptor languages and the AFL generated by the twoway (deterministic)(nonerasing) stack-acceptor languages are principal. A modification of the main argument shows that the AFL generated by the two-way pushdown-acceptor languages is also principal. Author (TAB)

N71-10504# Joint Publications Research Service, Washington, D.C.
ADVANCES IN ELECTRONIC AND ANALOG COMPUTERS
7 Oct. 1970 24 p refs Transl. into ENGLISH from Russian reports
(JPRS-51522) Avail: NTIS

Development and use of more sophisticated electronic and analog computers are discussed. Changes are made in the systems of units on which the computer is built, structure systems reflecting connections between separate devices, and the mathematical control of the machine. Applications to science and engineering problems, cost reductions, and microelectronics are also discussed for analog computers. E.H.W.

N71-10526*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ASTRONAUT/COMPUTER COMMUNICATION STUDY: PHASE A, TASK 2 REPORT
Sep. 1970 34 p refs Revised
(Contract NAS8-25701)
(NASA-CR-102905; MDC-G0492A) Avail: NTIS CSCL 09B

Crew functions for future spacecraft were established and ways in which the onboard computer can assist in performing these functions were identified. The ultimate purpose is to define a structured vocabulary and establish methods by which space scientists and astronauts can communicate (in performing onboard functions) with the onboard computer. Author

N71-10621# Naval Postgraduate School, Monterey, Calif.
INTERACTIVE GRAPH REDUCTION AND ANALYSIS PROGRAM
James Winton Thomas (M.S. Thesis) Jun. 1970 135 p refs
(AD-709927) Avail: NTIS CSCL 9/2

The paper describes the design of an interactive system to aid in the analysis of problems which involve directed graphs. The digital computing system is assumed to have a graphic display device on which directed graphs may be drawn and from which light pen, function keyboard, and alphanumeric keyboard information may be transmitted on-line to the system. Directed graphs are represented in core storage by a dynamically allocated hierarchical list structure. User-written analysis routines are linked to the system to apply it to a particular field of problems. An initial implementation of its capabilities on the IBM 360/67 with an IBM 2250 Display Unit was written in PL/I (F). Under the IBM System/360 Operating System, it executed in less than 200K bytes and provided reasonable response to on-line interaction. Author (TAB)

N71-10700# California Univ., Berkeley. Dept. of Electrical Engineering.
SWITCHING AND AUTOMATA THEORY Final Report, 1 Jun. 1967 - 30 Jun. 1970
A. Gill Aug. 1970 10 p refs
(Grant AF-AFOSR-0639-67)
(AD-711080; AFOSR-70-2298TR) Avail: NTIS CSCL 9/2

The research under the grant consisted of the following projects: 91) Extensive development of the theory of linear sequential circuits; (2) Solution of various problems in the theory of finite-state automata, including the counting of such automata, error correction capability, realization by input-output relations, periodicity properties and equivalence problems; (3) Solution of problems in the theory of stochastic automata and time-varying automata; (4) Research in formal languages, including context-free languages and multi-tape, multi-head pushdown automata; and (5) Solution of various operations-research type problems, such as optimization algorithms for finite, directed, weighted graphs, and the change-making problem. TAB

N71-10752# Harvard Univ., Cambridge, Mass.
INFORMATION PROCESSING TECHNIQUES FOR NETWORKING AND GRAPHICS RESEARCH Technical Report, 1 Jul. 1968 - 30 Jun. 1969
Thomas E. Cheatham, Jr. Jun. 1970 26 p refs
(Contract F19628-68-C-0379; ARPA Order 952)
(AD-711392; ESD-TR-70-202) Avail: NTIS CSCL 9/2

Work on the PDP-1 facility at Harvard has proceeded over a broad front for the past year FY 69; projects range from exploration of efficient display technology to computer art and include projects for computer assisted organic molecular synthesis, stereo and color display, character recognition, and tree manipulation. This report briefly summarizes the major accomplishments over the year and references the various published papers and technical reports which contain the detailed reports. Author (TAB)

N71-10785# Syracuse Univ. Research Inst., N.Y.
THEORY OF ADAPTIVE MECHANISMS. VOLUME 1: PART 1: SUMMARIES OF TECHNICAL REPORTS PUBLISHED IN 1967 AND 1968 UNDER THIS PROJECT. PART 2: TWO TOPICS IN AUTOMATA THEORY Final Technical Report, 8 Aug. 1966 - 31 Oct. 1969
K. A. Chen and A. Iosupovicz Griffiss AFB, N.Y. RADC Jul. 1970 98 p refs
(Contract F30602-67-C-0011)
(AD-711048; RADC-TR-69-403-Vol-1) Avail: NTIS CSCL 6/4

The results of a three year research study in automata theory and iterative array computers are presented in the report, which consists of four volumes and five parts. Volume I consists of Part 1 which contains summaries of technical reports published in 1967 and 1968 under the project, and Part 2, which consists of two short review papers on specific topics in automata theory. The first paper presents the main results of finite state probabilistic automata, Markov chains, and stochastic sequential machines, while the second presents some topics in the theory of linear sequential machines. Abstracts of the individual papers are given in the appropriate volumes. Author (TAB)

N71-10786# Syracuse Univ. Research Inst., N.Y.
THEORY OF ADAPTIVE MECHANISMS. VOLUME 2: PART 3: EFFICIENT MAXIMAL SEMANTIC RESOLUTION PROOFS BASED UPON BINARY SEMANTIC TREES Final Technical Report, 8 Aug. 1966 - 31 Oct. 1969
R. G. Cantarella Griffiss AFB, N.Y. RADC Jul. 1970 171 p refs
(Contract F30602-67-C-0011)
(AD-711049; RADC-TR-69-403-Vol-2) Avail: NTIS CSCL 6/4

A new proof procedure is presented which generates an efficient maximal semantic resolution proof of the inconsistency of any wff (well formed formula) of first order logic without equality. This is done by constructing one path at a time down a binary semantic tree. The new proof procedure has the parameters: any model for the wff and any total ordering of the Herbrand base of the wff. This technique is more efficient than the method of inference nodes because more powerful inferences are made and the path need not be constructed to the bottom of the binary semantic tree for a resolution to be performed. It is also more efficient than the British Museum Algorithm for maximal semantic resolution. For a propositional wff, it is shown that the prime implicants can be generated by repeated applications of binary resolution and the subsumption rule. Furthermore, the prime implicants which cover a particular model (i.e., a zero-cube on the Karnaugh map) can be efficiently generated by repeated applications of maximal semantic resolution and the subsumption rule. Author (TAB)

N71-10787# Syracuse Univ. Research Inst., N.Y.
THEORY OF ADAPTIVE MECHANISMS. VOLUME 4: PART 5: A NEW APPROACH TOWARD PARALLEL PROCESSING Final Technical Report, 8 Aug. 1966 - 31 Oct. 1969
F. L. Wang Griffiss AFB, N.Y. RADC Jul. 1970 110 p refs
(Contract F30602-67-C-0011)
(AD-711051; RADC-TR-69-403-Vol-4) Avail: NTIS CSCL 6/4

Based on the same logic circuit delay and main memory cycle, the performance of a computer system can be improved by better system organization and more efficient logic design. The general approach is by means of more parallel data paths and many processors operating simultaneously. A computer may be so designed that a sequence of instructions of a program can be executed concurrently whenever possible. It is called a confluent system. Another approach employs many processors connected as a matrix. These processors have a control unit which controls the instruction and data flow. It is very fast if the problem can be formalized in terms of matrices. A third approach is a multicomputer system in which several computers are connected through their common I/O devices and/or special data channels. A study of these systems leads to a new system organization. It has a variable configuration and can be used as either a multiprocessor system or a multicomputer system. It contains many program executors operating under a hardware supervisor. The supervisor itself is a program executor which can be assigned by the operator from one of a few special program executors. The unassigned units can be used as ordinary program executors. The basic difference of the proposed system from the other systems is that the program executors are very loosely coupled. Author (TAB)

N71-10788# Syracuse Univ. Research Inst., N.Y.
THEORY OF ADAPTIVE MECHANISMS. VOLUME 3: PART 4: DETERMINISTIC REALIZATION AND SIMULATION OF NONDETERMINISTIC AUTOMATA Final Technical Report, 8 Aug. 1966 - 31 Oct. 1969
F. R. Moore Griffiss AFB, N.Y. RADC Jul. 1970 82 p refs
(Contract F30602-67-C-0011)
(AD-711050; RADC-TR-69-403-Vol-3) Avail: NTIS CSCL 6/4

The report investigates the deterministic realization of nondeterministic finite automata through the subset construction. It had been speculated by Rabin that the exponential increase in the number of states in this construction could be improved. Contrary to this a class of nondeterministic automata is constructed by the author for which the subset construction yields a reduced, connected deterministic automata with exactly 2 to the n power states. Author (TAB)

N71-10870# Naval Ship Engineering Center, Philadelphia, Pa.
COMPUTER OPTIMIZATION OF THERMOCOUPLE CALIBRATION Final Report
David R. Keyser 25 Jul. 1970 100 p refs
(AD-710761; NAVSECPHILADIV-A-960) Avail: NTIS CSCL 14/2

The report presents two related improvements to the results of thermocouple calibration. The first is analytic: two computation schemes are recommended for drawing an unbiased calibration curve through the data. The second is experimental: the mean calibration curves for iron-constantan, chromel-alumel, and copper-constantan thermocouples have been determined experimentally. It was found that the calibration curves computed from a few data better fit this mean curve if the input data are observed at the relative maxima and minima of these mean curves. On this basis, the report recommends at which temperatures the calibrations should be performed for each of the three thermocouples. The computation methods are quite general and may be applied to any calibration where the correction or error relative to a theoretical value is the accepted format. Author (TAB)

N71-10872# System Development Corp., Santa Monica, Calif.
THEORY OF PROGRAMMING (ALGORITHMIC) LANGUAGES PROJECT Final Report, 5 Nov. 1969 - 30 Jun. 1970
Seymour Ginsburg 23 Jul. 1970 28 p refs
(Contract F44620-70-C-0013)
(AD-710843; TM-4579(000)00; AFOSR-70-2210TR) Avail: NTIS CSCL 9/2

The document is a final report for research on algorithmic languages, and covers the period from 5 November 1969 to 30 June 1970. It summarizes five scientific papers written, all of which deal with AFL (abstract families of languages), and discusses research results obtained but not yet reported. The report also lists the changes in publication status during the report period for the papers written under earlier AFOSR sponsorship. Author (TAB)

N71-10941# Information Management, Inc., San Francisco, Calif.
USER'S MANUAL: COBOL COMPLIER VALIDATION SYSTEM Technical Report, Aug. 1967 - Jan. 1969
Bedford, Mass. ESD Jul. 1970 157 p

(Contract F19628-67-C-0424)
(AD-711369; ESD-TR-70-274) Avail: NTIS CSCL 9/2

The report consists of detailed specifications for the use of the COBOL Compiler Validation System (CCVS). The system is designed to measure the compliance of a specific COBOL compiler against the American National Standards Institute standard COBOL (ANSI X3.23-1968). This report describes the card input formats, deck structures, tape requirements, test modules, and operator procedures required to use the system. Author (TAB)

N71-10946# Infoton, Inc., Burlington, Mass.
RESEARCH IN ADAPTIVE PATTERN RECOGNITION Final Report, 1 Apr. 1965 - 31 Mar. 1970
Donald B. Brick, William N. Furey, Jr., and Ernest G. Henrichon, Jr. 28 Aug. 1970 161 p refs
(Contract Nonr-4752(00))
(AD-711675; Rept-100-30) Avail: NTIS CSCL 6/4

The report contains a review of the significant aspects of studies which have not been extensively reported elsewhere. The emphasis has been on the development and evaluation of pattern recognition schemes whose performance either does not depend or has minimal dependence on a priori knowledge of the underlying statistical behavior of the pattern classes to be discriminated. Significant developments include: a nonparametric procedure which first transforms the unknown probability structure of a pattern discrimination problem to the real line and then partitions this induced space by a method based on the difference of empirical distribution functions; a least-squares functional expansion about the Bayes (optimum) decision surface which leads to a type of polynomial discriminant function; a transformation such that a class of stochastic processes can be characterized by the distribution of a set of discrete parameters; and two procedures for ranking features according to their effectiveness in discriminating among dichotomous pattern classes. Author (TAB)

N71-10966*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
NONPARAMETRIC AND LINGUISTIC APPROACHES TO PATTERN RECOGNITION
P. H. Swain and K. S. Fu Jun. 1970 195 p refs Sponsored in part by Dept. of Agriculture *Its* LARS Inform. Note No. 051970
(Grants NGL-15-005-112; AF AFOSR-1776-69; NSF GK-1970)
(NASA-CR-111119; AD-709732; TR-EE-70-20; AFOSR-70-2005TR) Avail: NTIS CSCL 09B

The report investigates two approaches to pattern recognition which utilize information about pattern organization. First, a nonparametric method is developed for estimating the probability density functions associated with the pattern classes. The dispersion of the patterns in the feature space is used in attempting to optimize the estimate. The second approach involves the structural relationships of pattern components, an approach called linguistic because it employs the concepts and methods of formal linguistics. The nonparametric density estimation technique is shown to produce acceptable results with real data and demonstrate a definite advantage over a parametric procedure when multimodal data is involved. Two alternative techniques are investigated for analyzing linguistic descriptions of patterns. Stochastic automata are considered as recognizers of stochastic pattern languages. The other technique is a stochastic generalization of the recently proposed programmed grammar which is developed as a grammar for pattern description. Author (TAB)

N71-10978# National Bureau of Standards, Washington, D.C. Center for Computer Sciences and Technology.
TECHNICAL HIGHLIGHTS, FISCAL YEAR 1969
1970 16 p ref
Avail: NTIS

The law and supporting policy guidance assigns to the National Bureau of Standards the responsibility for: (1) providing guidance in the promulgation of hardware and software standards, both for industry-wide voluntary standards and Federal standards; (2) providing other Government agencies technical assistance and consultation in both hardware and software areas in the efficient use of computers; (3) promoting training in the various areas of computer applications; (4) providing information services related to computer technology; (5) providing computer services—both use of equipment and programming—Government agencies; and (6) engaging in exploratory research. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-10020*# General Electric Co., Schenectady, N.Y. Tube Dept.
MULTISTAGE DEPRESSED ELECTROSTATIC COLLECTOR FOR MAGNETICALLY FOCUSED SPACEBORNE KLYSTRONS Final Report
W. Neugebauer and T. G. Mihran 14 Sep. 1970 89 p refs
(Contract NAS3-11532)
(NASA-CR-72767) Avail: NTIS CSCL 09A

A ten-stage electrostatic depressed collector was designed with the aid of an analog computer and tested on a 750-MHz klystron under varying conditions of drive. The measured performance showed excellent agreement with the design theory. At the full saturated rf power output, in excess of one kilowatt CW, the action of the collector raised the undepressed conversion efficiency of the klystron from 54.3 to 70.9 percent. This performance could only be achieved through the use of a small focusing coil between the output gap and the collector. Without this coil the corresponding net tube efficiency would have been 65.3 percent. At a lower drive level the collector raised the undepressed conversion efficiency from 29.2 to 54.2 percent, an increase of 25 percentage points. No spurious oscillations or instabilities were detectable and electron backstreaming was virtually non-existent. Intentional short circuiting of individual collector electrode pairs was shown to cause only minor degradation in collector performance. Author

N71-10044*# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
MAGNETORESISTANCE DEVICES Progress Report
T. W. Kim, H. Y. Yu, and W. W. Grannemann Jul. 1969 14 p refs
(Grant NsG-32-004-002)
(NASA-CR-110998; PR-92(69)NASA-028; Rept-290) Avail: NTIS CSCL 09A

Galvanomagnetic effects were studied to find higher magnetoresistance devices for a low-voltage high-current switch. The effect of the geometry of indium antimonide (InSb) and bismuth (Bi) magnetoresistance devices was considered in lowering the Hall voltage to create higher magnetoresistance. The use of self-biased electrical-field-enhanced magnetoresistance devices is proposed. The best geometrical shape is adopted and the electric field effect is used to increase the magnetoresistance of the devices. The use of an InSb p-n junction to obtain higher magnetoresistance and of p-n-p or p-i-n magnetic field-sensitive devices are considered. Author

N71-10054# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A GRIDDED THICK FILM METALIZATION STRUCTURE EMPLOYED IN MULTICHIP CIRCUIT FABRICATION

Helmut H. Pichler 4 Aug. 1970 33 p
(Contract AF 19(628)-5167)
(AD-710614; TN-1970-21; ESD-TR-70-228) Avail: NTIS CSCL 9/5

The note describes a process to produce a thick film circuit that holds as many as 40 integrated circuit chips and can be produced quickly at reasonable cost. Yield, equipment, materials and circuits are also listed. Author (TAB)

N71-10071# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF UHF SWITCH FOR LES-6 SATELLITE
Robert N. Assaly 4 Dec. 1969 126 p refs
(Contract AF 19(628)-5167)
(AD-710612; TR-473; ESD-TR-69-386) Avail: NTIS CSCL 9/5

A UHF switch matrix was developed for the LES-6 satellite to electronically despin the antenna beam as the satellite rotated on its axis. Initially, a study was carried out to determine the optimum antenna system and switch configuration for the constraints of satellite geometry and minimal complexity. Two such switch matrices, operated by logic circuits and sun and earth sensors, were used on the satellite, one to excite two adjacent of eight pairs of antenna dipoles, and the other to excite two adjacent of eight pairs of cavity-backed slots. The polarizations of the signals from the dipoles and slots are orthogonal and by adjusting the phase difference to 90 degrees, the satellite will, in normal operation transmit and receive on right-hand circular polarization. Furthermore, by squinting the beam formed by two element pairs + 11.25 degrees or 11.25 degrees from the center line of the element pairs, any of 16 beams can be formed which are equally spaced in azimuth about the satellite. Each switch consists of three parts, namely, a hybrid to divide the input power into two equal parts, a 2 P2 T section which switches phase, and two SP4 T sections to switch on two antenna pairs. The switch was built in strip transmission line using PIN diodes in series with the inner conductor as the switching element. Author (TAB)

N71-10137# Royal Radar Establishment, Malvern (England).
THE GUNN EFFECT IN DEVICES OF NON-UNIFORM CROSS-SECTIONAL AREA
C. O. Newton *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The analysis of the Gunn effect centered on circular geometry, and a study of a noncircular system involving varying streamlines was initiated. For the circular system with electrodes defined by concentric cylinders, a simple means was devised for calculating the change in size of a domain with motion. The comparison between prediction and experiment is considered to be good when the theory is modified to include the deduction that a domain nucleates less easily if another domain already exists in the bulk of the specimen. N.E.N.

N71-10138# Royal Radar Establishment, Malvern (England).
CW TRANSFERRED ELECTRON OSCILLATORS FOR Q-BAND
B. C. Taylor and S. E. Gibbs *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Research on the LSA and domain modes of operation is reviewed, and problem areas and improvements associated with each oscillator type are described. It is felt that domain source will provide reliable low power CW oscillators, but that the sandwich structure and LSA mode will give Q-band sources with improved performance. N.E.N.

N71-10152# Royal Radar Establishment, Malvern (England).
AN APPROXIMATE TRANSISTOR NOISE MODEL DEVELOPED FROM A BASE CHARGE COMPENSATION ARGUMENT
S. W. Noble *In its* RRE Newsletter and Res. Rev., No. 8 1969 5 p (See N71-10126 01-34)
Copyright. Avail: NTIS

The simple argument developed avoids explicit consideration of correlations between the random processes of injection, extraction and recombination of carriers and gives reasonably accurate results over the useful frequency range of a transistor as an amplifier. The following simplifying assumptions are made: (1) The reverse saturation currents of the junctions are quite negligible compared with the working currents. (2) The emitter injection efficiency is unity. (3) The base contact only passes majority carriers. (4) The frequency range is insufficiently high to require consideration of the time required for minority carrier redistribution within the base region. (5) Space charge layer width modulation effects are negligible. Consideration is only given to the intrinsic transistor. Author

N71-10154# Royal Radar Establishment, Malvern (England).
AN INSTRUMENT UTILIZING THE VARIATION OF CAPACITANCE WITH APPLIED VOLTAGE IN SAMPLE DIODE JUNCTIONS TO DETERMINE THE IMPURITY PROFILE OF THE MATERIAL
P. J. Baxandall *In its* RRE Newsletter and Res. Rev., No. 8 1969 6 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

In the manufacture of devices such as gallium arsenide Gunn Effect diodes, a high degree of uniformity in doping concentration must be maintained over the whole device area and throughout the thickness of the active region. The instrument described gives quick information on the impurity concentration as a function of depth, one small area at a time being tested via small contact probes. Two output voltages are provided. Equipment test results are given. Author

N71-10156# Royal Radar Establishment, Malvern (England).
MOLYBDENUM-GOLD METALLISATION FOR MOST'S
G. F. Vanstone and E. C. Rich *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Molybdenum and gold contact materials for integrated circuits are under investigation. Deposition, etching, and bonding processing parameters for producing Mo-Au MOST circuits are discussed. E.C.

N71-10158# Royal Radar Establishment, Malvern (England).
INTEGRATED CIRCUITS AT MICROWAVE FREQUENCIES
A. F. Saunders, A. S. Young, and B. Bradford *In its* RRE Newsletter and Res. Rev., No. 8 1969 5 p (See N71-10126 01-34)
Copyright. Avail: NTIS

Microstrip substrate and Schottky barrier diode fabrication work is reviewed. A balanced mixer circuit is being developed using a 3 db hybrid coupler in microstrip and Schottky barrier diodes for mixing purposes. E.C.

N71-10160# Royal Radar Establishment, Malvern (England).
MICRO-STEP MOTOR
G. C. Joyce *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p (See N71-10126 01-34)
Copyright. Avail: NTIS

A linear motor was designed which moves along a V-block in extremely small steps. With suitable attachments it can form the basis of an electronically controlled micromanipulator. The step size can be varied from 4 microns (0.00016 in.) down to a small fraction of a micron and, in conjunction with a suitable measuring method, it can be positioned to an accuracy of 0.01 micron (0.4 microinches). The motor is of very simple construction. It comprises a piezo-electric ceramic tube, to each end of which is attached an electromagnet; the pole pieces of the electromagnets are precision

ground to mate with an iron V-block and act as clamps when energized. The motor is reversible and may be made to move to any chosen position in the V-block. The initial movement is made in coarse steps (4.0 microns) and the final positioning is made under continuously variable control so that extremely high setting accuracy is achieved. Author

N71-10161# Royal Radar Establishment, Malvern (England).
THE PRECISE MEASUREMENT OF COMPLEX REFLECTION COEFFICIENTS AND IMPEDANCE
R. E. Spinney and I. A. Harris *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

A technique previously used for measuring the modulus of reflection coefficient in waveguides is used for measurement of complex reflection coefficients and impedance. The reflectometer contains two adjustable impedance transformers. The impedance in a rigid coaxial line apparatus was measured at frequencies up to 1 GHz and at impedances between 49 and 51 ohms resulting in a sensitivity of within + or − 0.1% of the major component. E.C.

N71-10179# Naval Postgraduate School, Monterey, Calif.
MATHEMATICAL MODELING AND SENSITIVITY ANALYSIS OF RADIATION EFFECTS ON SEMICONDUCTOR JUNCTIONS
Leon Eugene Drouin, Jr. (M.S. Thesis) Jun. 1970 62 p refs
(AD-709929) Avail: NTIS CSCL 9/1

The thesis is concerned with the numerical solution of a semiconductor junction recovery from a radiation pulse. The junction is represented by an Ebers-Moll model to account for diffusion current and space-charge capacitance. The radiation pulse is considered as giving rise to a photo-current to which it is related by a linear differential equation. Exact solutions are presented and the recovery time is presented and discussed as a function of several parameters. A simple piecewise linear analysis for a diode circuit is also presented to provide insight into the nature of the transient response and the recovery time. Author (TAB)

N71-10215# Royal Radar Establishment, Malvern (England).
AVALANCHE DIODE MICROWAVE OSCILLATOR MODES
I. W. Mackintosh *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

An analysis for the diode-circuit interaction was developed which allows the construction of nonsinusoidal waveforms for a range of avalanche diode oscillator modes, and leads to a unified approach to normal and anomalous impatt modes. Expressions are given for the voltage, the time constant when the voltage is rising and the current falling, and the conduction current when it is rising rapidly. Conditions are described for lengthening the oscillation period and for extending the scheme to include multi-avalanche modes. N.E.N.

N71-10216# Royal Radar Establishment, Malvern (England).
S-TYPE NEGATIVE RESISTANCE DIODES
B. D. Joyce and H. D. Rees *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p ref (See N71-10201 01-34)
Copyright. Avail: NTIS

Research on developing InAsP as a microwave semiconductor, and in particular for negative resistance avalanche diodes, is described. Three preparation methods were tried: melt growth, and liquid and vapor epitaxy. Effort was concentrated on the epitaxial methods. Control of the arsenide phosphide ratio was adequate, and the Gunn effect and avalanche breakdown were observed in accordance with theory. Characteristics of the reverse bias junction are given. N.E.N.

N71-10217# Royal Radar Establishment, Malvern, (England).
ENCAPSULATION RESONANCE IN CW GUNN DIODES FOR J AND Q BANDS
B. C. Taylor, S. J. Fray, and S. E. Gibbs *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

The effects of diode encapsulation parameters on oscillator characteristics and the severe limitations they impose are discussed. Encapsulation resonance frequency, and its effects on the limit of upper frequency attainable, tuning characteristics, oscillator operation, and post reactance are described. N.E.N.

N71-10218# Royal Radar Establishment, Malvern (England).
THE PREDICTION AND MEASUREMENT OF THE PHASE ANGLE BETWEEN FREQUENCY LOCKED OSCILLATORS OVER A RANGE OF OPERATING CONDITIONS
H. R. Holliday *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Research is described which was undertaken to determine how the phase angle between a locked Gunn oscillator and its locking source depends upon parameters such as locking power, temperature, bias voltage, and bias on the varactor. A mathematical expression is given for the phase angle between oscillator and its locking source, and predicted and measured phase angles show close agreement. It is felt that the most convenient form of phase control would be to vary the bias on a varactor coupled into each cavity. N.E.N.

N71-10220# Royal Radar Establishment, Malvern (England).
A SIMPLE TECHNIQUE FOR THE ACCURATE DETERMINATION OF DELAY TIME VARIATIONS IN ACOUSTIC SURFACE WAVE STRUCTURES
J. D. Maines, E. G. S. Paige, A. F. Saunders, and A. S. Young *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

The technique is based on the conversion of the delay of an acoustic surface wave delay line into an oscillation at a single frequency, and is applicable to the measurement of very small changes in velocity. The delay line is placed between the output and input of a suitable amplifier and measurements are made of the changes in frequency of oscillations which occur when the gain of the amplifier exceeds the insertion loss of the delay line. Measurements of the delay time changes with temperature for surface waves propagating in the Z direction on a Y cut of lithium niobate are described. It is felt to be essential either to control the temperature or to find an alternative cut and propagation direction. N.E.N.

N71-10221# Royal Radar Establishment, Malvern (England).
MIS MEMORY TRANSISTORS
M. Barraclough, J. E. Bounden, B. Bradford, M. A. C. S. Brown, and G. F. Vanstone *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Double layer gate insulators are described for a long-term charge storage. A p-channel memory transistor is fabricated using standard planar technology. A 1-10 ohm-cm n-type silicon slice has source and drain diffusions of boron. The first insulator is SiO_2 produced by chemical means or oxidation. The second insulator is Si_3Ni_4 deposited by vapor phase reaction of silane and ammonia. A description compatible with first order effects is given of the interface and bulk traps. Charge retention with zero applied voltage was observed for up to one month at room temperature on MNOS capacitors, and precise measurements show a small decrease in charge in the first few minutes and very little change thereafter. N.E.N.

N71-10222# Royal Radar Establishment, Malvern (England).
ELECTRONIC CONTROL IN THE RRE HIGH MAGNETIC FIELD LABORATORY
J. W. Stearn *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p (See N71-10201 01-34)
Copyright. Avail: NTIS

Two pieces of power supply equipment under construction and concerned with very high current control and stabilization are described. One is a 0-10,000 A, 60 kW supply for show short sample superconductor testing, and the other is a 0-12,500 A, 3.5 MW supply for providing power to the solenoids. The problems associated with the closed loop control system are ensuring adequate stability around the loop while maintaining a wide enough passband to accommodate load and supply variations, and developing protective circuits to combat faults. Sample current and magnet current stabilization are discussed and methods of overcoming or minimizing their problems are described. N.E.N.

N71-10223# Royal Radar Establishment, Malvern (England).
APPLICATION OF A MIXED MOS AND BIPOLAR TRANSISTOR SILICON INTEGRATED CIRCUIT OPERATIONAL AMPLIFIER
R. C. Bowes and E. F. Good *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p ref (See N71-10201 01-34)
Copyright. Avail: NTIS

The development is reported of MOS and bipolar transistors diffused onto one silicon chip which draw an input current of about 0.1 picoamp. The MOS devices do not give as good voltage stability as junction devices, and the amplifiers show a zero drift in a few hours. The amplifiers give an output of over + or − 5 V, allowing readings with an inaccuracy of less than 1%. Typical applications are identified as picoammeters, very high resistance voltmeters, and very low frequency ringing circuits. N.E.N.

N71-10457# Michigan State Univ., East Lansing. Div. of Engineering Research.
INVESTIGATION OF OPEN-CAVITY RADIATORS AND BACKFIRE ANTENNAS. PART 1: OPEN-CAVITY ANTENNAS
Ming H. Hong, Dennis P. Nyquist, and Kun-Mu Chen Jul. 1970 129 p refs
(Contract F19628-70-C-0072)
(AD-711071; AFCRL-70-0361; SR-1) Avail: NTIS CSCL 9/5

This research investigates the radiation and circuit properties of an open-cavity radiator. This antenna consists of a simple, open-ended circular cavity with a primary radiator, placed at an appropriate location inside the cavity. If a reflecting disk is placed at the aperture of this radiator, it becomes a short backfire antenna. The waveguide excitation theory is employed to find the field excited in the cavity. The aperture field is then determined by summing the propagating modes at the open end of the cavity, and the radiation field is calculated based on the aperture field. The input resistance of the radiator is obtained from the total radiated power carried by the propagating modes and the input current of the primary radiator. Various primary radiators such as a dipole, a dipole array, a transmission line, and a circular loop are considered. An experimental study has been conducted parallel with the theoretical analysis and a satisfactory agreement has been obtained between theory and experiment. Author (TAB)

N71-10510# Naval Research Lab., Washington, D.C. Semiconductors Branch
DETECTOR DEVELOPMENT Annual Report, 1 Jul. 1969 – 30 Jun. 1970
S. Teitler and W. J. Moore 30 Jun. 1970 28 p refs
(ARPA Order 1387)
(AD-711119) Avail: NTIS CSCL 9/1

The report describes some recent efforts to study and understand the performance and the noise properties of state-of-the-art Hg(1-x)Cd(x)Te infrared detectors under low background conditions. Particular emphasis has been placed on the study of the low frequency noise properties of these detectors. Author (TAB)

N71-10516# Illinois Univ., Urbana. Coordinated Science Lab.
SERRASOID GENERATION FOR EXTENDED-RANGE FREQUENCY MODULATION
Robert John Kubela Aug. 1970 53 p refs
(Contract DAAB07-67-C-0199)
(AD-710832; UILU-ENG-70-226; R-483) Avail: NTIS CSCL 9/5

Wideband frequency-modulated signals may be produced by an extension of the Armstrong method if suitable cosine phi and sine phi waveforms are generated, where phi is the phase of the modulated signal. The generation of these involves complex and expensive circuitry in which parameters must be continuously and accurately varied. It is possible to first generate serrasoidal waveforms analogous to cosine phi and sine phi which can be converted to the latter. Such serrasoidal signals could conceivably be simple to generate, since corresponding circuitry involves only integrators, threshold detectors, and polarity-switching gates; circuits which are linear except during brief switching periods. Two experimental serrasoid generators were constructed whose designs are described. Adverse response to small input signals occurred, and appear inherent to the technique. This response, and the relative complexity of suitable polarity-switching gates indicate that the described approach cannot favorably compare with more conventional frequency-modulation schemes. TAB

N71-10530# Naval Postgraduate School, Monterey, Calif.
THE ANALYSIS AND SYNTHESIS OF A FOURTH-ORDER ACTIVE FILTER
Kenneth Kiyoshi Yasutome (M.S. Thesis) Jun. 1970 33 p refs
(AD-710733) Avail: NTIS CSCL 9/5

The realization of linear-phase-shift and constant-time delay transfer characteristics using computer-aided analysis and synthesis of a fourth-order highpass active filter was the main objective of this investigation. Two approaches were to be taken in the analysis and synthesis phase. Only one using topologically oriented programs was completed. The second involved the derivation and analysis utilizing the system transfer function. Author (TAB)

N71-10533# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF KALMAN'S AND HOWITT'S EQUIVALENCE TRANSFORMATIONS
Eric Crittenden Honour (M.S. Thesis) Jun. 1970 54 p refs
(AD-710725) Avail: NTIS CSCL 9/5

Kalmans and Howitts equivalence transformations are applied to the canonic impedance and admittance Foster LC forms and the Cauer ladder realizations for an RC circuit. The results provide a format for transforming from one realization to another directly. Application of the Kalman transformation to second-order Brune and Bott-Duffin realizations indicates that they are not compatible, implying the incompleteness of Kalmans transformation theory. The same technique is used to show a similar incompleteness of Howitts theory. Author (TAB)

N71-10588# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
AN ENGINEERING EVALUATION OF PRECISION NON-WIREWOUND POTENTIOMETERS FOR AN/PPS-5 RADAR
Herschel L. Stout Jun. 1970 36 p ref
(AD-710947; ECOM-3297) Avail: NTIS CSCL 9/1

A new technique for examining potentiometers in the vicinity of the dead space and termination areas is introduced. The DEAD SPACE CHARACTERISTIC provides information which cannot be

obtained from the FUNCTION CHARACTERISTIC and offers a superior means of identifying certain types of degradation. (A THOR) TAB

N71-10570# Physics International Co., San Leandro, Calif.
DEVELOPMENT AND APPLICATIONS OF MYLAR STRIPLINES Final Report
Steven L. Shope, Ian D. Smith, Gerry Yonas, Phillip Spence, and Rodney Ward Jan. 1970 148 p refs
(Contract DASA01-69-C-0016)
(AD-711109; PIFR-137; DASA-2482) Avail: NTIS CSCL 9/1

The report covers the development and application of Mylar striplines capable of producing currents in excess of 1 MA with pulse widths on the order of 50 nsec. The low-voltage line has a maximum operating voltage of 200 kV and a total impedance of 0.1 ohms. The high-voltage line can be operated up to 750 kV and has a total impedance of 1.8 ohms. Both lines use Mylar as the energy storage medium and are switched with solid dielectric switches. The low-voltage line drives a low-inductance diode that is used for the production of electron beams. The high-voltage line drives a double-sided diode with a line impedance of 3.6 ohms driving each side of the diode. The double-sided diode uses two opposing cathodes with a thin anode between them. Author (TAB)

N71-10600*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INVESTIGATION OF THE DEVELOPMENT OF CRACKS IN SOLDER JOINTS
Barnes Beasley 3 Mar. 1970 40 p refs
(NASA-TM-X-53963; NASA-TM-X-53824) Avail: NTIS CSCL 09C

A study was made to investigate the development of cracks in solder joints on printed circuit boards and to recommend solutions to this problem. This study consisted of two approaches. One approach, an analytical investigation, was to perform a mathematical analysis of the joints in question with emphasis on the force applied to the solder joint; the second approach, an empirical investigation, was performed to determine the extent of damage caused by temperature cycling of printed circuit boards and to determine or evaluate the practical validity of the proposed solutions. Author

N71-10618* Electro-Optical Systems, Inc., Pasadena, Calif.
FOCUSSING SYSTEM FOR AN ION SOURCE HAVING APERTURED ELECTRODES Patent
Robert C. Speiser and Gordon Sohl, inventors (to NASA) Issued 28 Mar. 1967 (Filed 18 May 1964) 4 p Cl. 313-63 Sponsored by NASA
(NASA-Case-XNP-03332; US-Patent-3,311,772;
US-Patent-Appl-SN-368123) Avail: US Patent Office CSCL 09E

An electrode system for an ion source is described in which the plasma density is nonuniform across the diameter of the source. The system comprises screen and accelerating electrodes positioned face-to-face with apertures in registration with each other. The apertures vary in size in accordance with radial displacement from the center of the electrode and inversely to the plasma density. E.C.

N71-10659* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SINGLE OR JOINT AMPLITUDE DISTRIBUTION ANALYZER Patent
George M. Tetsuka, inventor (to NASA) Issued 2 May 1967 (Filed 21 May 1964) 6 p Cl. 324-77 Sponsored by NASA
(NASA-Case-XNP-01383; US-Patent-3,317,832;
US-Patent-Appl-SN-369336) Avail: US Patent Office CSCL 09E

A device is described for analyzing electrical waveforms which represent the amplitude distribution of a time function. The device employs a cathode ray oscilloscope having the face of the tube masked except for an aperture located in the center. An electrical signal with a waveform representative of the amplitude distribution of the time function is applied repeatedly to the cathode ray tube, and is combined each time with another step of a stair-step voltage. The electron beam of the oscilloscope is biased on only in response to clock pulses generated at a predetermined frequency by a crystal oscillator, as a result of which a light pulse is seen through the hole in the mask of the tube only when the waveform and step amplitudes position the pulsed beam in the window. Two data flows comprising the amplitude distribution of two time functions can be analyzed simultaneously to obtain the joint amplitude distribution characteristics. R.B.

N71-10666# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTACTS BETWEEN CHALCOGENIDE GLASSES, METALS AND SEMICONDUCTORS Quarterly Management Report
H. K. Henisch 1 Sep. 1970 4 p
(Contract DAHC04-70-C-0047; ARPA Order 1562)
(AD-711221) Avail: NTIS CSCL 9/1

The two main purposes of the research described were to elucidate the mechanism of threshold switching and to explore new device possibilities through the use of contact materials which can be electronically altered in situ. Author (TAB)

N71-10673* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVERSIBLE RING COUNTER EMPLOYING CASCADED SINGLE SCR STAGES Patent
John N. Libby and Harry D. Moore, inventors (to NASA) Issued 2 May 1967 (Filed 4 May 1964) 5 p Cl. 307-88.5
(NASA-Case-XGS-01473; US-Patent-3,317,751;
US-Patent-Appl-SN-364867) Avail: US Patent Office CSCL 09E

A series of cascaded ring circuits are provided which can be sequentially operated in either the forward or in the reverse direction. Each individual ring stage consists of a silicon controlled rectifier (SCR), three condensers, two resistors, and two steering diodes. The anode of the SCR is connected through a resistor to the potential source, the cathode is capacitor coupled to the gates of the preceding and subsequent stages, and the gate of the SCR is capacitor coupled to the anodes of the preceding and subsequent stages. The capacitor coupling permits either forward or reverse operation of the ring counter. R.B.

N71-10677* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRONIC BEAM SWITCHING COMMUTATOR Patent
Philip A. Studer, inventor (to NASA) Issued 6 Jun. 1967 (Filed 21 Oct. 1964) 7 p Cl. 318-138
(NASA-Case-XGS-01451; US-Patent-3,324,370;
US-Patent-Appl-SN-405629) Avail: US Patent Office CSCL 09E

A dc motor using an electron beam switching tube as a commutator is described. The electron beam is sequentially switched to succeeding outputs by a pulse input switch controlled by a variable frequency oscillator. The oscillator is responsive to control signals from both a transducer device and a rotor position sensing device. The brushless motor commutation process is thus responsive to both rotor angular velocity and rotor position. R.B.

N71-10751# Avco Corp., Cincinnati, Ohio. Electronics Div.
EVALUATION OF A COMPACT TEST CHAMBER FOR IMPEDANCE AND POWER TESTING OF ANTENNA AS-1729/VRC Final Report, 16 Jun. 1969 – 17 Feb. 1970
Glen J. Seward Mar. 1970 87 p refs
(Contract DAAB05-67-C-0174)

(AD-711111; ECOM-0174-1; Rept-80045-USM2/370) Avail: NTIS CSCL 9/5

The report describes the evaluation and testing of a compact, fully enclosed chamber intended for electrical alignment and testing of VHF whip antennas during production. The chamber was specifically designed for alignment, VSWR testing, and RF power testing of the AS-1729/VRC vehicular antenna which operates from 30 to 76 MHz and is part of the VRC-12 series of radio sets. Tests revealed that the antenna could be made to perform in the chamber in a manner similar to that on a 10 x 10 foot ground screen in free space. It was necessary to add some top loading to the antenna when installed in the chamber, thereby achieving the desired current distribution and impedance performance across the frequency range. Capability for base alignment was verified by testing a group of 30 production antennas aligned in the chamber. Suitability for power testing was also verified experimentally. A time study of the total time to align antennas in the chamber versus conventional RF bridge alignment showed that appreciable cost savings was possible by using the chamber. Author (TAB)

N71-10794# Sandia Corp., Albuquerque, N.Mex.
THEORY OF THE ANNULAR SLOT ANTENNA: INTEGRAL EQUATION FOR THE APERTURE FIELD, ADMITTANCE, LEADING TERM IN THE NEAR AND FAR-ZONE FIELDS, AND EFFECTIVE HEIGHT
Charles W. Harrison, Jr. and David C. Chang (Colorado Univ.) 8 May 1970 30 p refs
(SC-R-70-4281) Avail: NTIS

The general theory of annular slot antennas is developed. The treatment is novel in that no Green's functions or contour integrations arise. The principle of duality is employed. Topics discussed include formulation of the integral equation for the aperture field and derivations of the leading term in the near and far zone fields and effective height. The theory has application in calibrating near-zone field strength instrumentation, and in determining the response of an unsheathed coaxial cable connector mounted flush with the skin of a missile to intense plane-wave electromagnetic field pulses. Author

N71-10798* Massachusetts Inst. of Tech., Cambridge.
ELECTRONIC AMPLIFIER WITH POWER SUPPLY SWITCHING Patent
Manuel Kramer, inventor (to NASA) Issued 9 May 1967 (Filed 27 Jul. 1964) 8 p Cl. 330-22 Sponsored by NASA
(NASA-Case-XMS-00945; US-Patent-3,319,175; US-Patent-Appl-SN-385530) Avail: US Patent Office CSCL 09E

An apparatus for increasing the power conversion efficiency of electronic amplifiers by power supply switching is described. Comparator circuits continuously monitor the voltage across the load connected to the amplifier output and compare it with reference voltages of the dc power supply. In accordance with load voltage demands, a switching circuit associated with each comparator selectively connects a power supply voltage across the power amplifying element of the amplifier. The minimum voltage of the available power supply voltages sufficient to maintain linear operating characteristics of the amplifier is applied across the power amplifying element. R.B.

N71-10828# Naval Civil Engineering Lab., Port Hueneme, Calif.
INSERTION LOSS AND PULSE RESPONSE OF POWER LINE FILTERS
Donald L. Chaffee and D. B. Clark Jun. 1970 59 p refs
(AD-711317; NCEL-TN-1111) Avail: NTIS CSCL 9/5

The report presents the results of test and evaluation of commercially available AC power filters, and examines the filter pulse response in light of its measured and calculated pass band characteristics. The power line source impedances encountered in insertion loss measurements have been measured and modeled by an equivalent circuit. A coaxially shielded bench set-up for convenient insertion loss measurement of power filters utilizing the NCEL current injection probe method was devised. The insertion loss and pulse response have been determined theoretically and compared with experimental measurements for some unique filters designed to prevent inductor saturation. The effects of resistive damping to improve a power filters pulse response have been investigated, and recommended damping techniques presented. The effect of varying the load power factor upon the resistive damped filter performance has been determined. Author (TAB)

N71-10893*# Stanford Research Inst., Menlo Park, Calif.
TRIPLEXER FOR WIDEBAND VARACTOR FREQUENCY TRIPLER Final Report
B. M. Schiffman, E. G. Cristal, L. Young, and D. Parker Jun. 1970 82 p refs
(Contract NAS12-2165; SRI Proj. 8035)
(NASA-CR-111784) Avail: NTIS CSCL 09E

A triplexer for a third harmonic varactor multiplier is described. Designed to cover the maximum bandwidth, that is one for which the third and fourth harmonic bands are contiguous, the triplexer and its associated harmonic rejection filters embody a wide range of microwave stripline filter design techniques. These include quarter wave stub, parallel-coupled and reentrant type resonators for bandstop filters, and interdigital and digital elliptic-type construction for bandpass filters. The triplexer consists of two diplexers composed of singly-terminated pseudo-complementary bandstop and bandpass filters with Chebyshev response. Test results on this device with respect to its triplexing function (excluding harmonic generation tests with a varactor) are given. The impedance matching network for the varactor diode was designed using a computer optimization approach. The tripler efficiency was analyzed using a time-domain analysis program in which a punch-through diode characteristic was assumed. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N71-10002# Electrotechnical Lab., Tokyo (Japan).
THE MICROWAVE IMPEDANCE STANDARDS
Toshio Nemoto May 1970 101 p refs In JAPANESE; ENGLISH summary *Its* Circ. No. 708
Avail: NTIS

Research on precise microwave impedance measurement methods and development of instrumentation for establishing new national standards of microwave impedence are described. The purpose and background of this research are described. The concept that a multiport circuit is useful for precise microwave impedance measurement is introduced. The equivalent generator method, which is developed to facilitate a scattering matrix analysis of complicated microwave circuits problems, is described. Three different types of problems are solved to demonstrate the utility of the method; the response from generalized reflectometers, the properties of cascaded multiports in terms of their elements, and the properties of multiports whose number of available ports have been reduced. The response of a four port circuit is analized. It is proved that if a symmetrical hybrid is used, two different responses will be obtained under certain circuit conditions; one response is proportional to the reflection coefficient of one load, and the other proportional to the vector sum of reflection coefficients of two loads. A convenient way for obtaining these circuit conditions is also shown. Author

N71-10058# California Univ., Berkeley. Electronics Research Lab.
JOINT SERVICES ELECTRONICS PROGRAM Interim Report,

1 Feb. 1969 – 30 Apr. 1970
D. J. Angelakos and J. R. Whinnery 30 Jun. 1970 101 p refs
(Grant AF-AFOSR-1488-68)
(AD-709945; ERL-70-2; AFOSR-70-1860TR) Avail: NTIS CSCL 9/3

The report constitutes an interim technical report for the period February 1, 1969 – April 30, 1970, and includes the following information. Section 2 contains information on research personnel affiliated with the ERL and the JSEP. Section 3 summarizes research efforts by respective research areas. Section 4 lists journal articles, talks and memoranda sponsored either in whole or in part by the JSEP. TAB

N71-10067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION RESULTS AND ACCURACY IMPROVEMENT OF TWO FLUX-SWITCHING MATHEMATICAL MODELS FOR MAGNETIC CORES
J. Larry Spencer Washington Nov. 1970 33 p refs
(NASA-TN-D-6032; L-7300) Avail: NTIS CSCL 09C

The results of an evaluation of two flux switching models for magnetic cores, the Nitzan model and the Betts and Bishop model, are presented. The two models are compared on the basis of the types of core switching each describes and the fidelity with which each predicts the output voltage waveform of a ferrite core with inside diameter of 50 mils (1.27 mm) and outside diameter of 80 mils (2.03 mm). The results indicate that the Nitzan model is more accurate and more nearly complete because it describes shuttling and partial switching. The Nitzan model is more applicable to cores of the same material but different sizes because it uses separate parameters related to the core materials and the core dimensions. A method is presented by which both models can be extended to describe more accurately the switching of cores with smaller ratios of inside to outside diameter. Author

N71-10073# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FREQUENCY DOMAIN ANALYSIS OF A CLASS OF NONLINEAR NETWORKS
Jerzy Gorski-Popiel 26 Nov. 1969 49 p
(Contract AF 19(628)-5167)
(AD-710200; TN-1969-62; ESD-TR-69-350) Avail: NTIS CSCL 9/5

A method is given for analyzing in the frequency domain the performance of linear networks containing nonlinear resistors. The method is applied to the evaluation of the frequency performance of a reactively terminated mixer. Author (TAB)

N71-10097# Illinois Univ., Urbana. Coordinated Science Lab.
OPTIMIZATION OF DISTRIBUTED-LUMPED-ACTIVE NETWORKS
Mohammad-Ebrahim Mokari-Bolhassan Aug. 1970 81 p refs
(Contract DAAB-07-67-C-0199)
(AD-711058; UILU-ENG-70-229; R-484) Avail: NTIS CSCL 9/5

There are many engineering systems which cannot be reasonably modeled by lumped elements, but must be modeled by distributed elements. This is especially true in electrical networks at high frequencies and in integrated circuits. Herein are discussed some computer optimization methods for the design of lumped-distributed networks in which the parameters of the network are adjusted until certain engineering requirements are met. An efficient way to adjust the parameters is to utilize the gradient of the performance index. Two different algorithms are developed to generate the gradient of the performance index with respect to the adjustable parameters. The first method assumes that the network has a cascaded structure, and the gradient is obtained by calculus of variation techniques. The second method which proved to be more efficient is the adjoint network method. The adjoint network method developed previously, using Tellegens Theorem, for lumped-active networks in branch formulation is extended to distributed-lumped-active networks. For this, the port parameter formulation is used. These methods are applied to several practical examples. The first examples are on the design of UHF broad-band amplifiers with both real and complex loads (a slot antenna). The third example is the low noise matching of a slot antenna to a transistor amplifier. The last example is a design of a low-pass distributed-lumped-active filter. Some of the designs have been built and the measurements show close agreement with the calculated results. A survey of stability criteria which were used in the designs is included. Author (TAB)

N71-10225# Royal Radar Establishment, Malvern (England).
CAMP: A SYSTEM FOR COMPUTER AIDED MASK PRODUCTION
J. Wood, R. S. Newton, and D. J. Snell *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p (See N70-10201 01-34)
Copyright. Avail: NTIS

The CAMP system, part of a joint project on computer aided design of silicon integrated circuits, supports production of the masks used in circuit manufacture. The system is described and ways of improving its performance in design and graphics work are mentioned. E.C.

N71-10384*# Texas Univ., Austin. Electronics Research Center.
SENSITIVITY ALGORITHM FOR A RANDOM ERROR IN KALMAN FILTER AND PREDICTORS
Demetrios G. Lainiotis and Malcolm R. Railey Feb. 1970 23 p refs
(Grants NGR-44-012-066; AF-AFOSR-0786E-67; AF-AFOSR-1764-69)
(NASA-CR-111108; AD-701432; AFOSR-70-0400TR) Avail: NTIS CSCL 9/4

A sensitivity algorithm is developed for the continuous-time Kalman filter and predictor when random errors exist in the model parameters. Random errors occur in the design of the Kalman estimator when the dynamical and statistical parameters of the model are not completely known. The uncertainties in these parameters result in the errors being random. This sensitivity algorithm permits the evaluation of the filter and predictor a priori design and provides a designer a technique to simplify the sensitivity analysis procedures. Author (TAB)

N71-10426*# Naval Postgraduate School, Monterey, Calif.
COMPUTER-AIDED DESIGN OF LINEAR NETWORKS IN THE FREQUENCY DOMAIN Final Report
Donald E. Kirk 11 Jun. 1970 50 p refs Prepared for JPL
(Contract NAS7-100)
(NASA-CR-111103; AD-709084; NSP-52KI0081A) Avail: NTIS CSCL 09E

The design of linear networks to satisfy frequency domain performance specifications is formulated as a problem in nonlinear programming. Three optimization algorithms, pattern search, gradient projection, and the Fletcher-Powell method, are applied in conjunction with the network analysis program CALAHAN to the solution of the nonlinear programming problem. Examples which illustrate the range of application of the design programs are presented. Author (TAB)

N71-10515# Technische Univ., Berlin (West Germany). Fakultaet fuer Elektrotechnik.
A CONTRIBUTION FOR THE IMPROVEMENT OF SURGE VOLTAGE DISTRIBUTION IN LAYER WINDINGS [EIN BEITRAG ZUR VERBESSERUNG DER STOSSPANNUNGSVERTEILUNG IN LAGENWICKLUNGEN]
Hischem Djouchadar (Ph.D. Thesis) 1968 116 p refs In GERMAN
Avail: NTIS

Voltage distribution in transformer windings is evaluated for capacitive and inductive couplings. Developed is an inductive control mechanism for favorable initial voltage distribution as well as for industrial winding manufacture. Coupling processes in single and double layer windings are used to develop inductivity controls in conformation with winding dimensions and insulation demands. Layer inductivity is controlled by an e-function which determines capacity up to the upper 50% of layers with 33% of the overall windings. Substitution of the e-function by a parabolic control function gives optimal internal crossover capacity and the economic design of basket-wound coils. Transl. by G.G.

N71-10578* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
VOLTAGE-CURRENT CHARACTERISTIC SIMULATOR Patent
Jerome H. Grayson, inventor (to NASA) Issued 13 Jun. 1967 (Filed 27 Nov. 1964) 7 p Cl. 323-8
(NASA-Case-XMS-01554; US-Patent-3,325,723; US-Patent-Appl-SN-414482) Avail: US Patent Office CSCL 09C

A device is described for simulating the voltage-current characteristics of a solar cell panel. The simulator uses a diode string in series with a variable resistance and a variable reverse bias voltage supply. Selective switching is provided for controlling the number of diodes which may be placed in the circuit. The shunt and load resistance of the single cell equivalent circuit are represented by variable shunt resistors. By proper choice of simulator components and selected values of its variable components, it is possible to control the voltage-current outputs of the device to simulate the voltage-current characteristic curves of a solar cell panel with different operational parameters. R.B.

N71-10620# Naval Postgraduate School, Monterey, Calif.
INVESTIGATIONS OF THE MIYATA SYNTHESIS TECHNIQUE
Richard Eric Carlson (M.S. Thesis) Jun. 1970 49 p refs
(AD-709928) Avail: NTIS CSCL 9/5

These investigations generalize Miyatas synthesis of passive driving-point impedance functions by developing a step-by-step computational technique for augmenting a general driving-point impedance to insure that the real part of the augmented impedance is positive term by term. This goal has been accomplished and programmed under the provision that the real part of the original impedance is minimum reactive, i.e., has no zeros on the j(omega)-axis. The latter requirement is not restrictive since zeros on the j(omega)-axis. Author (TAB)

N71-10819 Auburn Univ., Ala.
FILTERING AND OPTIMIZATION OF LINEAR STOCHASTIC SYSTEMS WITH CROSS-CORRELATED NOISE
Narendra Prasad Dwivedi (Ph.D. Thesis) 1969 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-21310

The combined problem of filtering and optimal control, for a linear stochastic system with cross-correlation between input and (additive) output noise, was reduced to two independent problems of filtering and optimal control. This property holds whether or not the cost functional is quadratic. An earlier result of this type, called the separation theorem, for identically zero cross-correlation and a quadratic cost is extended and generalized. In the process, a rigorous derivation of Kalman's extension of the Kalman-Bucy filter is provided. The theory is illustrated by two simple examples, and it is shown how this can be applied to the fine pointing control system of the Apollo telescope mount. Dissert. Abstr.

N71-10958# Joint Publications Research Service, Washington, D.C.
LONG-RANGE PROBLEMS OF SOVIET CYBERNETICS
V. Glushkov 28 Sep. 1970 44 p Transl. into ENGLISH from Znamy (Moscow), no. 8, 1970 p 145-176
(JPRS-51457) Avail: NTIS

A historical review of the development of cybernetics theory is presented. Examples are given to illustrate the role of cybernetics in transportation, metallurgy, economics, and production control. Future trends of applications of cybernetics are discussed. R.B.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-10069*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ADVANCED JET ENGINE COMBUSTOR TEST FACILITY
Paul W. Adam and James W. Norris Washington Nov. 1970 31 p refs
(NASA-TN-D-6030; E-5710) Avail: NTIS CSCL 14B

A test facility for conducting full scale advanced annular jet engine combustor research and durability tests is described. Combustors were operated on ambient or heated ASTM-A1, natural gas, and propane fuels to an average exit temperature of 2400 F (1589 K). The airflow of 285 lb/sec (129.4 kg/sec) at 1200 F (922 K), 115 psia (79.2 N/sq cm), and 60,000 ft (18,240-m) altitude exhaust capability allows simulation of combustor inlet conditions over most of the range of interest in supersonic cruise engines. Description of a unique jet engine fired, nonvitiating air heater is included. The test section, the instrumentation, the data acquisition system, and operation techniques and experiences are also described. Author

N71-10114# Federal Aviation Administration, Washington, D.C. Systems Maintenance Service.
REPORT ON SYSTEMS MAINTENANCE PROGRAM EVALUATION CONDUCTED IN THE EASTERN REGION, 22 JULY-15 AUGUST 1969
Oct. 1969 42 p ref
Avail: NTIS

Significant strengths and weaknesses identified in the SMS evaluation of the Eastern Region maintenance program are summarized. Findings are based on visits to sectors and Airway Facilities Branches (AFB) in the Region's four areas (Washington, Cleveland, Boston and New York), to the Airway Facilities Division (AFD) and other regional headquarters elements, and on study of pertinent documents. It is concluded that budgetary limitations and other factors have affected SM program management and execution. Author

N71-10170# Federal Aviation Administration, Washington, D.C.
THE DEMAND FOR USE OF WASHINGTON NATIONAL AIRPORT
Joseph V. Yance Jan. 1970 82 p refs
Avail: NTIS

The air carrier demand for use of Washington National Airport (DCA) is studied (based on a CAB survey of flights) at the Washington-Baltimore area airports to determine the feasibility of a pricing system for landing and takeoff slots to reduce the congestion at DCA. The two components of passenger traffic, enplanements (and deplanements) at area airports, and through traffic are analyzed. It is concluded that a pricing policy would result in economic benefits to the airport, community, and the passengers. F.O.S.

N71-10186# Avco-Everett Research Lab., Everett, Mass.
HIGH PRESSURE HIGH ENTHALPY TEST FACILITY
E. R. Pugh, R. M. Patrick, and A. M. Schneiderman Jun. 1970 35 p refs
(Contract AF 49(638)-1483)
(AD-710316; AERL-RR-340; AFOSR-70-2080TR) Avail: NTIS CSCL 14/2

The feasibility of using a magnetic annular arc as the accelerator for a high pressure, high enthalpy flow test facility is discussed. Simple design criteria based upon empirical relations obtained in experiment indicate that this type of accelerator would have advantages over the usual arc type heaters at stagnation pressures up to 100 atmospheres. The advantage increases at higher flow enthalpies and correspondingly lower pressures. A pulsed prototype for such a facility operating for one millisecond was constructed. It demonstrated successful operation at pressures above atmospheric and that the accelerator operates as a pump in contrast to being only a heater with measured pressure rises of more than a factor of 4 across the accelerator. Author (TAB)

N71-10270# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DESIGN AND OPERATION OF THE IMPERIAL COLLEGE NUMBER 2 HYPERSONIC GUN TUNNEL
D. A. Needham, G. M. Elfstrom, and J. L. Stollery May 1970 48 p refs
(IC-Aero-70-04) Avail: NTIS

The design of the gun tunnel to operate with drive pressures up to 15,000 psia and of the auxiliary equipment is described. Details are given on tunnel components, gas services, instrumentation, and tunnel performance. It is concluded that performance characteristics of the tunnel with Mach 9 nozzle demonstrate that this type of facility can be used successfully to generate test section unit Reynolds numbers greater than a million per inch at M = 9. The test jet from the nozzle is uniform, permitting investigations of two and three dimensional flow fields. Data on stagnation pressure and temperature, running time, pitot pressure, and unit Reynolds number are given. N.E.N.

N71-10347# Federal Aviation Administration, Washington, D.C.
THE THEORY OF AIR CARRIER DEMAND FOR SLOTS
Joseph V. Yance Jan. 1970 35 p refs
(PB-193350) Avail: NTIS

A study directed at exploring the possible use of airport pricing in achieving optimal utilization of airports, particularly those in the Washington-Baltimore area, is presented. Author

N71-10356# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A HISTORY OF THE NATIONAL AVIATION FACILITIES CENTER, 1958 - 1970
Aug. 1970 102 p ref
Avail: NTIS

A narative account is given of the center's organization and reorganizations, resources, employee/management cooperation, and technology. The latter includes air traffic control, all weather radar, communication, aircraft safety, bird hazards, fire fighting, and human factors engineering. Activities of individual divisions are also considered. N.E.N.

N71-10417# TRW Systems Group, Redondo Beach, Calif.
HIGH-SPEED JETPORT ACCESS: FEASIBILITY STUDY OF A DEMONSTRATION PROJECT IN SOUTHERN FLORIDA Final Report
Dec. 1969 576 p refs
(Contract C-353-66(Neg))
(PB-192842; FRA-RT-70-38; TRW-06818-6044-R0-00) Avail: NTIS HC$10.00/MF$0.65

The feasibility of a high speed access system as a transportation demonstration project to a new Southern Florida Jetport was determined. Several candidate systems were considered and included vertical-takeoff (VTOL) and short-takeoff (STOL) airborne vehicles, in addition to high speed rail (HSR), monorail systems (MRS), and tracked air cushion vehicles (TACV) ground vehicles. The evaluation of the perspective alternatives was made using technical performance and cost considerations over similar routes connecting a jetport to the main population centers in Southern Florida. Several jetport locations were postulated and considered in the evaluation of the routes and terminal requirements. A Tracked Air Cushion Vehicle (TACV) system capable of a cruise speed of approximately 150 mph is recommended as the initial jetport high speed access system. This system provides economic transportation for the projected airport access demands and for growth to the high speeds desired for future interurban service. A performance description, preliminary implementation plan, and cost estimates are provided for the recommended system from a jetport to Miami. A general description of the expanded network is also presented with data for long-range planning and the development of programs for financing. Author

N71-10478# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
DESIGN OF AN INTERMITTENT, SINGLE JACK FLEXIBLE NOZZLE SUPERSONIC WIND-TUNNEL FOR MACH NUMBERS 1.5 TO 4.0
I. Kadushin and J. Rom [1970] 39 p refs
(TAE-86) Avail: NTIS

This report describes the design of a single jack flexible nozzle wind-tunnel having a 400 mm × 500 mm test section and capable of operation between Mach numbers of 1.5 to 4.0. Description of the wind tunnel installation, the pressure air supply and other auxiliary systems of this wind-tunnel are presented. The main design features were tested in one-fifth scale model wind-tunnel. The results of the model tests are in good agreement with the design requirements. Author

N71-10604* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HYDRAULIC SUPPORT FOR DYNAMIC TESTING Patent
George Landwehr von Pragenau, inventor (to NASA) Issued 28 Mar. 1967 (Filed 24 Jun. 1964) 8 p Cl. 73-116
(NASA-Case-XMF-03248; US-Patent-3,310,980; US-Patent-Appl-SN-377780) Avail: US Patent Office CSCL 14B

A support apparatus is described for dynamic testing of space vehicles under conditions approaching those of free flight. The support apparatus has a vertically floating piston with a near-frictionless means for regulating oscillatory motion. Self-adjusting, near-frictionless bearings are on the piston to transmit the weight of the test vehicle to the piston. The floating piston allows for test vehicle vertical motion and the self-adjusting bearings allow for horizontal translational and rotational motion. E.C.

N71-10679# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior Ballistics Lab.
COOLING WATER SYSTEM, COMPRESSOR PLANT NO. 1
Ernest P. Reklis Jun. 1970 29 p
(AD-710971; BRL-TN-1735) Avail: NTIS CSCL 14/2

In the operation of the BRL Supersonic Wind Tunnels it is necessary to hold the air temperature at the entrance to the tunnels to a constant given level. This report describes the cooling system used to accomplish this and a few of the problems involved in its operation. Author (TAB)

N71-10681# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
RESTORATION OF LANDING MAT-SURFACED

SUBGRADES BY GROUTING METHODS Final Report
Cecil D. Burns and Victor C. Barber Jun. 1970 81 p *Its* Misc. Paper S-70-19
(AD-710962) Avail: NTIS CSCL 13/3

Engineering tests were conducted in order to evaluate the use of portland cement and asphaltic materials as grout for the repair of pumped subgrades under heavy-duty airfield landing mats and to develop equipment and criteria for their application. Author (TAB)

N71-10682# Ohio River Div. Labs., Cincinnati.
DEVELOPMENT STUDY FOR A VFR HELIPORT STANDARD LIGHTING SYSTEM Final Report
T. H. Morrow, Jr. Aug. 1970 136 p refs Sponsored in part by FAA
(AD-710982; CERL-TR-M-3) Avail: NTIS CSCL 1/5

The report describes a four part study directed toward a standard lighting system for heliport under visual flight rule (VFR) conditions. The investigation includes a laboratory model study, a preliminary field layout and two helipad installation tests using actual helicopter flight operations. Results were analyzed by pilot questionnaires and interims. Tentative recommendations for further testing are presented including all particulars of a heliport lighting system. Author (TAB)

N71-10746* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TRAINING VEHICLE FOR CONTROLLING ATTITUDE Patent
Harold I. Johnson, inventor (to NASA) Issued 1 Nov. 1966 (Filed 8 Dec. 1964) 7 p Cl. 35-12
(NASA-Case-XMS-02977; US-Patent-3,281,963; US-Patent-Appl-SN-416938) Avail: US Patent Office CSCL 05I

An attitude control training device for astronauts is described which permits friction-free movement with five degrees of freedom. The device consists of a tank of high pressure gas, a plenum chamber attached to the center of the tank, and a dish-shaped platform adapted to ride atop the plenum chamber on an air bearing. The top of the plenum chamber is concave for receiving the dish which is provided with a radius of curvature approximately equal to the vertical distance between the dish and the center of gravity of a subject standing upright on the dish. When standing on the dish, the subject is completely disengaged from the earth in the pitch, roll, and the yaw angles, and has full degrees of freedom in the fore and aft and side-to-side translational modes. R.B.

N71-10748* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
CONTROLLED VISIBILITY DEVICE FOR AN AIRCRAFT Patent
Kirk S. Irwin, inventor (to NASA) Issued 1 Nov. 1966 (Filed 2 Aug. 1965) 6 p Cl. 35-12
(NASA-Case-XFR-04147; US-Patent-3,281,965; US-Patent-Appl-SN-476761) Avail: US Patent Office CSCL 14B

A device is described for simulating flight conditions of poor or no visibility in training a pilot in instrument landing and flight procedures. The simulator is a window panel for an aircraft in which the cockpit visibility can be varied gradually from no visibility to good visibility in a manner similar to the conditions encountered by an aircraft breaking out from cloud cover in an instrument landing. Two superimposed polarizing lenses cover panels mounted over the cockpit windows in the field of view of the pilot. The lenses are rotated relative to one another to control the amount of light transmitted through the lens assembly. R.B.

N71-10776* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ROTATING SPACE STATION SIMULATOR Patent
Donald E. Hewes, inventor (to NASA) Issued 1 Nov. 1966 (Filed 13 Apr. 1965) 8 p Cl. 35-12
(NASA-Case-XLA-03127; US-Patent-3,281,964; US-Patent-Appl-SN-447927) Avail: US Patent Office CSCL 14B

A system is described for generating an artificial gravity by centrifugal forces to observe and test the self-locomotion capability of a test subject under a simulated rotation space station environment. The simulator has multiple levels to study the requirements of a test subject to walk from one section of a whirling space station to another, to propel himself slowly or rapidly up a ladder or stairway, and to study the individual reaction to varying floor arrangements. The system is designed to determine and evaluate the gravity requirements for astronauts and space explorers assigned to rotating space stations and manned space laboratories. R.B.

N71-10777* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MOLECULAR BEAM VELOCITY SELECTOR Patent
Robert Steinberg, inventor (to NASA) Issued 1 Nov. 1966 (Filed 30 Dec. 1966) 5 p Cl. 55-400
(NASA-Case-XLE-01533; US-Patent-3,282,035; US-Patent-Appl-SN-334678) Avail: US Patent Office CSCL 14B

A system is described for mechanical separation and discrimination of high velocity molecular particles. The selector is mounted on a vertical axis and uses a tapered disk to permit extremely high rotational speed. Longitudinal slots in the disk provide passage for the accelerated particles while discriminating against the slower moving particles. The slots are produced by an electrical discharge machine to insure minimum slot width and close spacing for good resolution. A circular plate fixed to the tapered disk and magnetically coupled to the windings of an electric motor rotates the particle selector. R.B.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-10010# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON THE MIXING OF ISOENERGETIC CONFINED CO-AXIAL JETS
W. Tabakoff and W. M. Hosney Jun. 1970 76 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-710284; THEMIS-AE-70-10; AROD-T-4-16-E) Avail: NTIS CSCL 20/4

A survey of experimental results for turbulent mixing between two compressible streams in a constant area duct is presented. The experimental results are for area ratios 3 and 7.16, for velocity ratios ranging from 0.4 to 2.8, and with velocity magnitudes varying from 200 ft/sec. to 950 ft/sec. A new constant of turbulence is recommended for the theoretical analysis of the confined jet mixing which uses the free jet mixing concepts. The regions in which this analysis could be used are delineated. Author (TAB)

N71-10088# National Engineering Lab., Glasgow (Scotland). Properties of Fluids Div.
PRESSURE, TEMPERATURE AND GAS CONTENT EFFECTS IN THE VIBRATORY CAVITATION TEST
J. M. Hobbs and A. Laird Oct. 1969 18 p refs
(NEL-439) Copyright. Avail: NTIS

Vibratory cavitation erosion tests have been made in water under carefully controlled conditions using testpieces of Duralumin, nickel, stainless steel and tellurium copper. Observed variations in erosion rate with temperature agreed with the findings of other workers and were little affected by air content. Erosion rates at constant temperature were reduced at very low air content and near saturation. Over the range of pressure investigated (0.35 to 3.0 bar) 5.0 to 43.5 lbs/sq in. the rate of erosion increased with the square of the pressure, but when allowance was made for vapour pressure, as in the net static pressure, the erosion rate was also found to be temperature dependent. Author

N71-10172# Naval Ship Research and Development Center, Washington, D.C.

AN APPLICATION OF LINEARIZED THEORY TO WATER ENTRY AND WATER EXIT PROBLEM. PART 2: WITH VENTILATION

Bohyun Yim Jul. 1970 37 p refs

(AD-709915; NSRDC-3171) Avail: NTIS CSCL 20/4

A conformal mapping technique is used to analyze two-dimensional thin foils entering a water surface vertically with ventilations. Boundary conditions are linearized, and the gravity effect is neglected. Flow fields, pressure distributions, and drags are given in closed forms for an infinite nonsymmetrical wedge, an infinite flat plate with ventilation from the leading edge, and a finite base-vented symmetrical wedge. Author (TAB)

N71-10173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TWO-DIMENSIONAL RECIRCULATION FLOW OF VISCOUS FLUID

Pavel Jonas 10 Jul. 1970 71 p Transl. into ENGLISH from Zprava Vzlu, 1962 p 1-31

(AD-710296; FTD-HC-23-56-70) Avail: NTIS CSCL 20/4

An idea of recirculation flow is explained and some examples of flows in nature and technique are shown. Traced out further is a physical problem connected with a study of the flows with a special view of two-dimensional case. According to G. K. Batchelor a region of two-dimensional recirculation flow at large Reynolds number may divide into a core and a recirculation boundary layer. The flows in these subregions are investigated separately. As a result of these investigations a method of two-dimensional solution of steady laminar recirculation flow at large Reynolds number is indicated. Some ideas of boundary layer theory had to be generalized in order to analyze the boundary layers at recirculation flow. Two known methods of solution of the boundary layer equation were modified so that boundary layers with nonzero condition for velocity on boundary (wall) might be solved. Simplified solution of a case of recirculation was done and a similar case of flow was realized. The results of measurements: qualitatively proved correctness of the important assumption that the recirculation boundarylayer was thin and gave experiences for investigating other recirculation flows. Author (TAB)

N71-10182# Singer-General Precision, Inc., Little Falls, N.J. Kearfott Div.

VORTEX FLOW FIELD STUDY Final Report, Jan. 1968-Sep. 1969

Michael J. De Santis and Edward L. Rakowsky Washington HDL May 1970 115 p refs

(Contract DAAG39-68-C-0033)

(AD-711032; HDL-TR-033-1) Avail: NTIS CSCL 20/4

An experimental investigation of the flow field in the pancake region of a three-dimensional axisymmetric vortex rate sensor was conducted. Basically the device consists of two coaxial cylindrical surfaces with outlet tubes located on the axis of symmetry perpendicular to the surfaces. Radial inflow of the fluid develops into a sink flow with a vortex generated by an angular rate input through fluid coupling at the periphery of the device. Detailed descriptions of radial and circumferential velocity profiles over a specific range of operating parameters are presented. Hot wire anemometry techniques were utilized to measure the velocity profiles. Experimental results indicate that for gap distances between the coaxial plates greater than 0.25 inches and an inlet radius of 11 inches, the vortex flow throughout is essentially inviscid with boundary layer development along the walls. For gap distances of 0.1 inches or less, fully developed flow occurs near the inlet of the pancake region for pure radial flow. The velocity profiles exhibit a parabolic distribution for pure-radial flow. Author (TAB)

N71-10199# Defense Documentation Center, Alexandria, Va.

NONEQUILIBRIUM FLOW. VOLUME 1: REPORT BIBLIOGRAPHY, DECEMBER 1959-JANUARY 1970

Aug. 1970 120 p refs

(AD-710400; DDC-TAS-70-57-1-Vol-1) Avail: NTIS CSCL 20/4

The annotated bibliography consists of 129 references to unclassified and unlimited reports which were processed into the AD data bank from January 1960 through March 1970. Corporate Author-Monitoring Agency, Subject, Personal Author, Contract, and Report Number indexes are included. Author (TAB)

N71-10242# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

A CRITICAL EVALUATION OF THE METASTABLE TIME-OF-FLIGHT TECHNIQUE FOR OBTAINING MOLECULAR VELOCITY DISTRIBUTIONS

J. W. Locke Dec. 1969 97 p refs

(Contract Nonr-4073(00))

(AD-711078; UTIAS-143) Avail: NTIS CSCL 14/2

The paper describes how a fundamentally new method for measuring the distribution of molecular velocities, the Metastable Time-of-Flight (MTF) method, was taken from the concept stage to a point where it may be used with a considerable degree of confidence by workers in such fields as rarefied gas dynamics, surface physics, and gas-phase chemistry. The sensitivity of the MTF method has been measured in absolute terms and as a function of impact voltage for ten common gases - He, Ne, Ar, Kr, Xe, N2, H2, CO and CO2. On the basis of the cross section values obtained, the MTF method might seem to be less sensitive than methods employing rotating mechanical systems with ionization detectors. However, other considerations such as the extremely narrow entrance slits required to achieve good speed resolution by mechanical methods mean that the two approaches are comparable in sensitivity in practice. It is shown that MTF does work well in the case of the first seven of these gases with the detector used and with a different detector would likely work with O2 and CO. There does not seem to be any hope of using MTF with CO2 as it lacks a suitable state. All second order effects associated with this method have been investigated and shown to be generally small. The hardware requirements for implementing the MTF technique are discussed at length including the design of the electronic instrumentation required. The result of this work is the existence of a new, well-characterized method for velocity analysis. Author (TAB)

N71-10244# Naval Postgraduate School, Monterey, Calif.

A DESIGN CRITERION FOR ARBITRARY DIFFUSERS

Donald Robert Gapp Jun. 1970 82 p refs

(AD-709909) Avail: NTIS CSCL 20/4

The study presents the derivation of a diffuser design parameter, which takes into account losses due to the geometry of the diffuser. A criterion for design of annular diffusers, using the design parameter to predict losses, is developed from reference data and model tests. A curved wall annular diffuser was designed and tested to verify the predictions of the design criterion for an arbitrary diffuser. Author (TAB)

N71-10249# Technion-Israel Inst. of Tech., Haifa.

INVESTIGATION OF HEAT TRANSFER IN BASE TYPE

SUPERSONIC LAMINAR AND TRANSITIONAL SEPARATED FLOWS

Josef Rom, Arnan Seginer, and Michael Green Apr. 1970 48 p refs

(Contract F61052-70-C-0005)

(AD-710347; TAE-111; ARL-70-0142; SR-1) CSCL 20/4

Heat transfer rate distributions were measured in the separated regions of a two-dimensional backward facing step, an axially symmetric backward facing step, a blunt two-dimensional base, a sharp protruding two-dimensional leading edge and in the leading edge bubble over the surface of a flat nosed two-dimensional model. The results of these measurements are compared with measurements of heat transfer rates in various base type separated flows obtained in various wind tunnels and to a calculation of heat transfer behind a backward facing step based on the integral method. In most of these investigations a high peak in the heat transfer rate is found to occur in the reattachment zone. Maximum heat transfer rate values of up to 10 times the flat plate heat transfer rate are reported in various investigations. An inverse relation between the value of the peak heat transfer rate and the distance between the separation point to the position of the maximum heating in the reattachment zone is shown to exist. Author (TAB)

N71-10296# Laval Univ. (Quebec). Lab. d'Aerodynamique.

THE EFFECTS OF HIGH PRESSURE STEAM ON THE POSITION OF THE REATTACHMENT POINT ON THE ADJACENT WALL OF AN INCOMPRESSIBLE JET [L'EFFET D'UNE SURPRESSION EN AVAL SUR LA POSITION DU POINT DE RECOLLEMENT D'UN JET INCOMPRESSIBLE A UNE PAROI ADJACENTE]

Nguyen Huan Mar. 1970 99 p refs In FRENCH

(A-15) Avail: NTIS

The reattachment point and the function of pressure and steam on bubble separation are determined using an extension of Bourque's theory. The critical stability is established for the prediction of reattachment on the adjacent wall. Results show predictions agree well with experimental data. For the flow of a parietal jet along an angle, a formula is developed to calculate the pressure forces along the adjacent wall and to compute the quantity of flow movements on the exterior angles. Trans. by E.H.W.

N71-10320*# Southwest Research Inst., San Antonio, Tex.

STUDIES OF PROPELLANT SLOSHING UNDER LOW-GRAVITY CONDITIONS Final Report, 4 Jan. 1966 - 10 Oct. 1970

Franklin T. Dodge 10 Oct. 1970 48 p refs

(Contract NAS8-20290)

(NASA-CR-102891) Avail: NTIS CSCL 20D

Experimental and analytical work reported on lateral propellant sloshing in axisymmetric tanks under low-gravity conditions centered on the derivation of mechanical sloshing models for use in stability and control analyses and the procurement of experimental data in simulated low gravity sloshing environments. Flexible baffles for slosh suppression at high Bond numbers and the use of magnetic-colloid liquids and solenoidal magnetic fields for smaller Bond number conditions are advocated. Also developed is a computer program that predicts natural frequencies and mode shapes for fuel sloshing in an arbitrary axisymmetric container. G.G.

N71-10321*# Southwest Research Inst., San Antonio, Tex.

SUMMARY OF RESEARCH

In its Studies of Propellant Sloshing under Low-Gravity Conditions 10 Oct. 1970 5 p refs (See N71-10320 01-12)

Avail: NTIS CSCL 20D

Mechanical models of sloshing are derived and used in stability and control analysis of the liquid. Liquids and tank materials with a zero degree contact angle are used for the investigation. The characteristics of inviscid fuel sloshing in axisymmetric tanks for arbitrary values of the Bond number and slosh supression in high Bond numbers are also discussed. A computer program is given for predictions of natural frequencies and mode shapes of the sloshings. E.H.W.

N71-10322*# Southwest Research Inst., San Antonio, Tex.

A COMPARISON OF FLEXIBLE AND RIGID RING BAFFLES FOR SLOSH SUPPRESSION

Luis R. Garza and Franklin T. Dodge *In its* Studies of Propellant Sloshing under Low-Gravity Conditions 10 Oct. 1970 2 p refs (See N71-10320 01-12)

Avail: NTIS CSCL 20D

A test program to determine the effectiveness of flexible ring baffles as liquid slosh suppressors was conducted. A comparison of flexible and rigid ring baffles is presented in terms of liquid damping, first mode sloshing resonant frequency, maximum baffle depth for no rotational slosh, and weight. Results indicate flexible ring baffles provide damping about equal to or better than that of rigid baffles, they have less weight, and maintain a more constant liquid resonant frequency through the baffle range investigated. E.H.W.

N71-10323*# Southwest Research Inst., San Antonio, Tex.

EXPERIMENTAL AND THEORETICAL STUDIES OF LIQUID SLOSHING AT SIMULATED LOW GRAVITY

Franklin T. Dodge and Luis R. Garza *In its* Studies of Propellant Sloshing under Low-Gravity Conditions 10 Oct. 1970 8 p refs (See N71-10320 01-12)

Avail: NTIS CSCL 20D

Analyses and experimental comparisons are given for liquid sloshing in a rigid cylindrical tank under conditions of moderately small axial accelerations. In particular, the theory is valid for Bond numbers larger than 10. The analytical results are put in the form of an equivalent mechanical model, and it is shown that the sloshing mass and the natural frequency of the first mode, for a liquid having a 0 deg contact angle at the tank walls, are smaller than for high-g conditions. The experimental data, obtained by using several small diameter tanks and three different liquids, are compared to the predictions of the mechanical model. Good correlation is found in most cases for the sloshing forces and natural frequency as a function of Bond number. Author

N71-10324*# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.

SIMULATED LOW-GRAVITY SLOSHING IN CYLINDRICAL TANKS INCLUDING EFFECTS OF DAMPING AND SMALL LIQUID DEPTH

Franklin T. Dodge and Luis R. Garza *In its* Studies of Propellant Sloshing under Low-Gravity Conditions 10 Oct. 1970 13 p refs (See N71-10320 01-12)

Avail: NTIS CSCL 20D

Liquid sloshing in cylindrical tanks is studied under conditions of simulated low gravities by using small diameter tanks to get surface tension forces comparable in magnitude to the body forces. In the tests, the effects of finite liquid depths and the determination of the smooth wall damping are emphasized. The experimental and theoretical results show that the fluid dynamics are affected by small h/d ratios in much the same way as for normal, large Bond number sloshing. Measurements of the slosh damping indicate that the damping increases as the Bond number decreases, and two correlation equations for the damping factor are proposed. An equivalent mechanical model developed previously is extended to include h/d variations and linear viscous damping. Comparisons of the force response predicted by the model to that measured in the tests verify the model to a high degree of confidence. Author

N71-10325*# Southwest Research Inst., San Antonio, Tex.

A THEORY FOR LOW-GRAVITY FUEL SLOSHING IN AN ARBITRARY AXISYMMETRIC RIGID TANK

Wen-Hwa Chu *In its* Studies of Propellant Sloshing under Low-Gravity Conditions 10 Oct. 1970 10 p refs Submitted for publication (See N71-10320 01-12)
Avail: NTIS CSCL 20D

Solutions to slosh force and moment for an arbitrary axisymmetric rigid tank at arbitrary Bond numbers are given. Pitching and translational oscillations are also given. Numerical examples are constructed and agree well with existing data. E.H.W.

N71-10334# California Univ., Berkeley. Coll. of Engineering.
SECOND-ORDER THEORY OF OSCILLATING CYLINDERS
Roger L. Potash Jun. 1970 168 p refs
(Contract N00014-69-A-0200-1023)
(AD-710767; NA-70-3) Avail: NTIS CSCL 20/4

Two-dimensional cylinders of arbitrary shape undergo small-amplitude forced sinusoidal motion in sway, heave and roll in (or near) the free surface of an infinitely deep ideal fluid. Equations for the theoretical fluid response to second-order are derived and their solution formulated in terms of Fredholm integral equations. A numerical procedure is developed and applied to three surface-piercing cylinder sections. Graphs of added mass, damping coefficient, pressure distribution, force and asymptotic wave amplitude as functions of non-dimensional wave number k are presented for the pure motions and for combined sway and heave, sway and roll, and heave and roll. The results indicate the significance of second-order coupling forces which result in the later motion cases. Additionally, second-order response coefficients are shown to be important in the higher frequency range. Author (TAB)

N71-10406# Laval Univ. (Quebec). Lab. d'Aerodynamique.
REATTACHMENT OF A SUPERSONIC LAMINAR BOUNDARY LAYER [RECOLLEMENT DE LA COUCHE LIMITE LAMINAIRE EN SUPERSONIQUE]
C. Bourque July 1970 43 p refs In FRENCH
(Grant DRB-B-9550-21)
(A-17) Avail: NTIS

The reattachment angles of a mixing laminar boundary were measured using a symmetric revolution model. The measurements included the Mach number and the angle of the cone on which the layer is attached. The angles obtained are 2 to 3 times greater than those predicted using the Chapman technique. Proposed criteria includes the effect of Reynolds number and the geometry of the model. The predictions are in agreement with the experimental measurements. Transl. by E.H.W.

N71-10421*# California Univ., Livermore. Lawrence Radiation Lab.
ON THE DYNAMICS OF SHOCK INTERSECTIONS
A. K. Oppenheim, J. J. Smolen, D. Kwak, and P. A. Urtiew 29 Apr. 1970 17 p refs Presented at 5th Symp. on Detonation (Intern.), Pasadena, Calif., 18 – 21 Aug. 1970
(Grant NGR-05-003-050)
(NASA-CR-111107; UCRL-72443) Avail: NTIS CSCL 20D

Upon recognition that collisions between shock intersections play a dominant role in the self-sustenance of detonations, an analysis of their dynamic properties is presented, covering a full scope of possible wave configurations in gaseous media as well as in condensed explosives. In both cases theoretical results and experimental records are shown to be in satisfactory agreement. Author

N71-10444*# Dynamic Science, Irvine, Calif.
TRANSONIC FLOW IN A CONVERGING-DIVERGING NOZZLE Final Report
Jay N. Levine and Douglas E. Coats Sep. 1970 125 p refs
(Contract NAS7-756)
(NASA-CR-111104; SN-168) Avail: NTIS CSCL 20D

The transonic equations of motion for a converging diverging nozzle, including the effect of variable gamma, were solved in toroidal coordinates using a combination of an asymptotic small parameter expansion and a double coordinate expansion. The analysis was kept general so that high order solutions could be recursively calculated. It was found that the use of toroidal coordinates and different expansion parameters did not significantly extend the range of normalized throat wall radii of curvature for which expansion solutions could be accurately calculated. An explanation of why expansion methods fail for small R is given. Calculations made, including the effect of variable gamma (for a homogeneous unstriated flow), indicate that its effect is negligible in the transonic region. A new technique for solving the subsonic portion of the nozzle flow is also described. Author

N71-10481# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
MEASUREMENTS OF THE HYPERSONIC, RAREFIED FLOW FIELD OF A DISK
Stewart Berlin Jan. 1970 36 p refs
(Grant AF-AFOSR-0697-67)
(AD-710641; USCAE-115; AFOSR-70-0194TR) Avail: NTIS CSCL 20/4

The flow density and temperature about a disk normal to a hypersonic, rarefied stream were measured. The tests were conducted in nozzle-produced flow fields of dry nitrogen. The electron beam fluorescence technique (EBT) was utilized to determine local fluid density and rotational temperature. In addition, impact pressure surveys were made in the wake and photographs of the flow field were obtained by traversing the electron beam with the camera shutter held open. Two higher Mach number centerline density and temperature profiles show qualitative agreement with free-molecular and first collision theoretical estimates. In general, the axial and lateral extents of the disk flow field are much greater than in continuum flow over the same geometry. The rotational temperature data indicates that essentially full temperature recovery is achieved near the forward stagnation point. The maximum shock layer densities, however, are somewhat below the Rankine-Hugoniot values for the given free stream Mach numbers due to the finite width of the electron beam and the thickening effect on the shock of the degree of gas rarefaction. Author (TAB)

N71-10463# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
TURBULENT BOUNDARY LAYER-SHOCK INTERACTION WITH AND WITHOUT INJECTION
Edgar Alzner and Victor Zakkay Wright-Patterson AFB, Ohio ARL Jun. 1970 177 p refs
(Contract F33615-68-C-1184)
(AD-710637; NYU-AA-69-24; ARL-70-0092) Avail: NTIS CSCL 20/4

Experimental results of turbulent boundary layer-shock interaction at Mach 6 using a 10 deg axisymmetric wedge around an axisymmetric centerbody are presented and an effort is made to obtain a simple numerical solution of this problem by the time dependent unsteady method. Static pressure, pitot pressure and total temperature profiles, wall static pressure, heat transfer measurements and optical data were obtained. Air and hydrogen are injected to study their effects on the interaction region. Wall heat transfer and pressure distributions for different injection rates of both air and hydrogen are presented. Detailed mappings of Mach number, pressure distributions and shock wave locations are derived for the air injection as well as the no injection case. Experimental results show a natural boundary layer thickness of about .85 inches, a separated flow region about two inches long and a pressure plateau characteristic of turbulent flow. Author (TAB)

N71-10473# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
SOME PRELIMINARY OBSERVATIONS ON TRANSITION

IN A PIPE

I. Wygnanski (Boeing Sci. Res. Labs.) Apr. 1970 41 p refs Sponsored in part by Boeing Co.
(TAE-108) Avail: NTIS

Conventional and conditionally sampled hot-wire measurements were taken in a pipe at Reynolds numbers corresponding to the onset of turbulence. It was observed that the laminar velocity profile is being distorted in an axisymmetric fashion with increasing Re. At Re > 4000 the increase of Re has no significant effect on the shape of the laminar velocity profile even when turbulent slugs appear. Some gross characteristics of turbulent slugs were examined and among them it was found that a typical slug is symmetrical provided that it originates in the pipe and it is not triggered by an obstacle at the inlet. Average measurements of turbulence within the slug were made and, on the surface, it appears that a turbulent slug behaves in much the same way as the fully developed turbulent pipe flow. Some preliminary observations were made near the turbulent-non-turbulent interface. Author

N71-10476# California Univ., Livermore. Lawrence Radiation Lab.

SOME NUMERICAL EXPERIMENTS WITH RAYLEIGH-TAYLOR INSTABILITY FOR A COMPRESSIBLE INVISCID FLUID

W. P. Crowley 6 Apr. 1970 22 p refs Sponsored by AEC
(UCRL-50845) Avail: NTIS

Growth rates for Rayleigh-Taylor instabilities in a compressible inviscid fluid were obtained by a numerical simulation technique. Two-dimensional flows having initial Atwood numbers of 1, 1/3, and 1/15 were studied; the calculations were limited to the small amplitude regime by numerical difficulties. Accelerations were provided by a pressure boundary condition. It appears that the final growth rate is independent of compressibility, but the details of growth are not. For the strong shock case, an empirical relation is presented which gives this amplitude reduction as a function of compression and Atwood number. The two-dimensional results obtained here compare quite well with results obtained using D. Maxwell's one-dimensional technique, particularly for the rarefaction problems. Author

N71-10479# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

THE CALCULATION OF ADIABATIC LAMINAR BOUNDARY LAYER SHOCK WAVE INTERACTIONS IN AXI-SYMMETRIC FLOW. PART 1: HOLLOW CYLINDER-FLARE BODIES WITH ZERO SPIN

Harry P. Horton May 1970 68 p refs
(VKI-TN-63) Avail: NTIS

A method is described for calculating the overall properties of flare-induced laminar boundary layer shock wave interactions on axi-symmetric bodies at zero incidence, under adiabatic conditions. The method consists of an extension to axi-symmetric flow of the two-dimensional integral boundary layer method of Lees and Reeves, in the improved form recently developed by Klineberg. The relationship between the local slope of the displacement surface and the external Mach number is calculated by a suitable inversion of the second-order shock-expansion method of Syvertson and Dennis. Satisfactory agreement is demonstrated between the theory and measurements on hollow cylinder-flare models at Mach numbers of 2.2 and 4.0. Author

N71-10481# Technische Hogeschool, Eindhoven (Netherlands).

GAS TRANSFER IN A FLUIDIZED BED

A. A. H. Drinkenburg (Ph.D. Thesis) 22 Sep. 1970 132 p refs
Avail: NTIS

In a fluidized bed the gas flow is split into two parts, one percolating through the bed between the individual particles (the dense phase flow), the other rising as separate voids (the bubble flow). The residence time in the bed for the latter part is short. Between the two partial flows mass can be transferred. The mass transfer rate is extremely important for many purposes for which use is made of the fluidized bed, such as chemical reactions, drying, etc. A theory has been developed for the mass transfer between the bubbles and the dense phase. The resulting equations have been solved numerically for many conditions. To test the validity of the theory experiments have been performed on an artificial bubble, with real single bubbles, and in a free bubbling bed. Author

N71-10546# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

EXPERIMENTAL INVESTIGATION OF THE TRAJECTORIES AND VELOCITIES OF SOLID PARTICLES ENTRAINED BY FLUID FLOWS IN CASCADE NOZZLES

W. Tabakoff and M. Hussein Aug. 1970 31 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-711121; THEMIS-AE-70-12; AROD-T-4.18-E) Avail: NTIS CSCL 10/1

The study of the trajectories and velocities of solid particles suspended in a fluid flowing through a cascade nozzle is of importance to the investigation of erosion damage sustained by the blades. In general, the trajectories and velocities of the particles depend upon the slope of the cascade nozzle, particle and flow inlet conditions, particle material density, mean diameter, angle of attack and initial place of collision. The particles are more likely to follow the fluid streamlines when their material density is of the same order of magnitude as that of the fluid and when their mean diameter is small. In the investigation, a cascade row of turbine blades was mounted in a cascade tunnel to produce the desired gas-particle flow. A high speed camera was used to photograph the flow, and the subsequent film analysis provided the data for the particle velocities and the particle paths through the cascade nozzle. The particles used are of mean diameter of 1000 microns. Author (TAB)

N71-10623# Iowa State Univ. of Science and Technology, Ames.

MEASUREMENT OF TURBULENT DIFFUSION AT SHORT OBSERVATION TIMES USING SPIN-ECHO NMR

Marlyn Jerome Murtha (M.S. Thesis) May 1970 93 p refs
(Contract W-7405-eng-82)
(IS-T-386) Avail: NTIS

A flow observation technique based on spin-echo nuclear magnetic resonance (NMR) was used to obtain statistical volumetric data of eddy motion in turbulent flow. The NMR procedure, using 90 to 180 degrees Carr-Purcell pulses, was particularly adapted to flow observation over very short times. This provided Lagrangian turbulence data for the initial phase of the correlation decay. The technique used to obtain the data is described. E.M.C.

N71-10764*# General Dynamics/Convair, San Diego, Calif.

LOW GRAVITY PROPELLANT CONTROL USING CAPILLARY DEVICES IN LARGE SCALE CRYOGENIC VEHICLES: RELATED IRAD STUDIES

Aug. 1970 56 p refs
(Contract NAS8-21465)
(NASA-CR-102902; GDC-DDB70-009) Avail: NTIS CSCL 20D

Studies summarized include screen flow testing, bubble dynamics, pullthrough and residual prediction, settling, and a survey of surface tension property values. Dutch twill and square weave screens were tested to determine pressure drop characteristics in the laminar and turbulent regimes using liquid and gaseous hydrogen and nitrogen, water, and gaseous helium. Data for the dutch twill screens were correlated by a semiempirical expression containing viscous and inertial terms. Square weave screen data agreed with a correlation based on a sudden expansion model. Expressions were derived for low and normal gravity pull through which can be used for baffled and unbaffled tanks. These relationships, when

combined with the flow equations of a capillary device in a draining tank and screen flow data, yield a set of simultaneous differential equations which when solved numerically provide a tool for predicting propellant residuals. An analytical model was developed to describe the temporal and spatial evolution of bubbles in low gravity environments. Author

N71-10802# Addis Translations International, Woodside, Calif.
FORCED CONVECTION OF AMMONIA. PART 2: GASEOUS AMMONIA. CASE OF VERY HIGH WALL TEMPERATURES (1000 TO 3000 DEG K)
Paul Perroud et al [1970] 151 p refs Transl. into ENGLISH from the French Report CEA-R-3728 Prepared for Los Alamos Sci. Lab.
(LA-TR-70-12; CEA-R-3728) Avail: NTIS

The heat transfer coefficients and pressure drops of gaseous ammonia in forced convection were measured experimentally. The fluid flowed at a rate of 0.6 to 2.4 g/sec. through a long electrically heated tungsten tube (i.d. = 2.8 mm, o.d. = 5.1 mm, L = 688 mm). The temperature of the wall reached 3000 K and that of the fluid 2500 K. The maximum heat flux was 530 W/sq cm. The ammonia underwent complete dissociation, and the power required for this process amounted to 30% of the total power exchanged. The inlet pressure varied between 6 and 16 bars, and the maximum pressure drop in the tube was 15 bars. Two regimes of dissociation were identified--the catalytic and the homogeneous--and the variations in the rate of dissociation along the tube were studied. The measured heat transfer coefficients may be about ten times those calculated by means of classical formulas. Correlations of experimental results are presented, using both enthalpy and temperature as the driving force for the transmission of heat. The pressure drops may be calculated with the aid of the classical friction factor. Author (NSA)

N71-10942# Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
AIR ADMISSION AND FLOW AERATION IN HYDROTURBINES [VPUSK VOZDUKHA I AERATSIYA POTOKA V GIDROTURBINAKH]
N. K. Barkov Mar. 1970 24 p refs Transl. into ENGLISH from Elektr. St. (Moscow), v. 39, no. 8, 1968 p 26-29
(PB-193589T; Trans-635) Avail: NTIS CSCL 13G

Various methods of atmospheric and compressed air admission in hydraulic turbines are briefly described. Presently, atmospheric air is used successfully in hydraulic turbines for (1) filling in the breaks in flow continuity, (2) preventing erratic conditions and dangerous vibration during periods of abnormal flow whirling in the draft tube, and (3) stabilizing flow for partial loading and off-design head operation. Compressed air injection is accomplished by several techniques and practical devices. Compressed air is used to reduce erosive wear in hydraulic turbines due to cavitation. Research shows that air in flow cavities significantly lowers the rate of cavitation damage. It also appears to be highly effective in controlling pressure surging beyond the turbine runner. Further study of air injection is required to improve the reliability and operation of contemporary hydromachines. Author (USGRDR)

N71-10943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTABILITY AND DAMPING OF DETONATIONS IN TWO-PHASE MEDIA
S. K. Aslanov 1 Jul. 1970 11 p refs Transl. into ENGLISH from Dopo. Acad. Nauk Ukr. RSR, Ser. A (Kiev), v. 31, no. 7, 1969 p 622-624
(AD-711753; FTD-HT-23-370-70) Avail: NTIS CSCL 19/4

The problem of gas-dynamic stability of a detonation wave propagating in an aerosol created from a dilute (solid) combustible, naturally comes up whenever the stationary theory of this process is mentioned; its purpose is to explain the possibility of its realization. The report is an attempt at such an investigation, with the assumption that there is a small volumetric concentration of droplets (PARTICLES) in the gas. The latter usually takes place for atomized hydrocarbon fuels, whenever the mixture is within the considered limits. Author (TAB)

N71-10967# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
SIMILAR SOLUTIONS IN VIBRATIONAL NONEQUILIBRIUM NOZZLE FLOWS
N. Muniswamy Reddy and Fred. L. Daum 1970 17 p refs Presented at the AIAA Fluid and Plasma Dyn. Conf. (3d), Los Angeles, 29 Jun.-1 Jul. 1970
(AD-711684; ARL-70:0144; AIAA Paper-70-804) Avail: NTIS CSCL 20/4

The problem of obtaining similar solutions in pseudo-one-dimensional nozzle flows with vibrational relaxation is considered. The governing equations are transformed into a similar form by using a new similarity parameter eta so that the nonequilibrium flow solutions depend on two parameters for a given kind of gas. However, the similar equations are further reduced to a universal form by a transformation of the independent variable eta to xi such that the similar solutions, for all combinations of initial conditions and for a defined family of nozzle shapes, depend on a single parameter chi which are then presented in a single graph. It is also shown that the equilibrium solutions depend on only one parameter xi. The parameters xi and chi are also the exact, general correlating parameters. With the present similar solutions the flow quantities in a nozzle are readily determined without resorting to complex computer programs. Author (TAB)

N71-10975# Naval Academy, Annapolis, Md.
THE WAKE OF A CATALYTIC FLAT PLATE IN A LOW DENSITY DISSOCIATED GAS FLOW
Daniel L. Pike 15 May 1970 64 p refs
(AD-711291; USNA-TSPR-12) Avail: NTIS CSCL 20/4

Experimental measurements of the concentration profiles in the wake of a catalytic flat plate are reported. Tests were conducted in a glow discharge tube at pressures of .1 to 1 Torr, using oxygen as the working gas and centerline velocities on the order of 1000 cm/sec. The oxygen was weakly dissociated (about 5%) by a radio frequency driven induction coil, upstream of the test section. The flow then passed a silver coated flat plate, which catalytically recombined the oxygen in its vicinity. The resulting concentration wake was then surveyed using a constant temperature hot catalytic thermistor probe. A concentration analog to the classical laminar momentum solution for the wake of a flat plate at zero incidence was proposed with the diffusivity playing an analogous role to the kinematic viscosity. Tests conducted at plate Knudsen numbers of .110 and .330 produced good correlation with the classical continuum wake theory, even though these flows were conducted in a regime where continuum theory loses its validity. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-10003# York Univ., Toronto (Ontario).
KINETICS OF ATMOSPHERIC CONSTITUENTS Final Report, 1 Jul. 1966-14 Apr. 1970
H. I. Schiff Jun. 1970 8 p refs

(Contract DA-ARO(D)-31-124-G868)
(AD-710282; AROD-5806-4-C) Avail: NTIS CSCL 7/4

The report summarizes research directed to obtaining fundamental reaction rate and transport data of interest in the stratosphere, mesosphere and the ionosphere of the earth. To this end particular attention was directed towards the reactions involving reactants and products containing appreciable quantities of internal energy. A flowing afterglow system was constructed and used to study rates of ion-molecule reactions. The method developed in our laboratory to measure diffusion coefficients of atomic species was used to obtain values for H-atoms in a number of gases.
Author (TAB)

N71-10018# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, JULY 1970 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, JULI 1970]
Jul. 1970 43 p In GERMAN and ENGLISH
(Rept-289-F) Avail: NTIS

Daily summaries are presented for vertical echo sounding of the upper atmosphere over Freiburg, Germany during July 1970. The data include charts of median values for the E and F regions. MUF(3000)F2, M(3000)F2, h'F2, hpF2, foF1, MUF(3000)F1, M(3000)F1, h'F, foE, foE2, h'E, foEs, fbEs, h'Es, Type Es, foT, and fmin.
R.B.

N71-10042*# Wyoming Univ., Laramie.
SIMULTANEOUS MEASUREMENT OF ATMOSPHERIC DUST BY LASER AND BALLOON SOUNDING TECHNIQUES
Final Report, 1 Nov. 1968 - 30 Jun. 1970
James M. Rosen Jul. 1970 99 p
(Grant NGR-51-001-019)
(NASA-CR-111798) Avail: NTIS CSCL 04A

The major goal of the research was to develop a better understanding of atmospheric aerosols and study them relative to atmospheric phenomena such as clear air turbulence. The relation between the aerosol concentration and optical properties of the atmosphere were studied in a series of four simultaneous laser backscatter and dust soundings. The secondary goal of the research was to develop a small compact aerosol sounding device primarily for balloon-borne measurements. Two types of detectors were developed and tested.
Author

N71-10046*# Techtran Corp., Glen Burnie, Md.
MODEL OF VARIATIONS IN DENSITY OF THE EARTH'S ATMOSPHERE AT ALTITUDES OF 30-80 km [MODEL VARIATSIIY PLOTNOSTI ATMOSFERY ZEMLI NA VYSOTAKH 30-80 km]
Yu. G. Sikharulidze et al. Washington NASA Oct. 1970 15 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 8, no. 4, 1970 p 526-534
(Contract NASw-2037)
(NASA-TT-F-13359) Avail: NTIS CSCL 04A

The degree and nature of possible deviations in atmospheric density from standard density were used in formulating an algorithm for control of spacecraft motion in the atmosphere. A model of density variations at altitudes of 30 to 80 km for latitudes from 50 deg S to 50 deg N is developed. The total deviation is represented in the form of the sum of the systematic and random components, including seasonal-latitudinal and diurnal variations. The individual components are investigated and formulas for their computation are derived. The most unfavorable cases of a possible atmospheric state in which the spacecraft trajectory is perturbed to the maximum degree are defined.
Author

N71-10078*# United Kingdom Atomic Energy Authority, Harwell (England).
THE LUMINESCENT AND THERMOLUMINESCENT PROPERTIES OF GRANITE AND ITS CONSTITUENT MINERALS AND THEIR RELEVANCE TO TRANSIENT LUNAR PHENOMENA
I. M. Blair and J. A. Edgington *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 22-28 refs Prepared in cooperation with Queen Mary Coll. (See N71-10076 01-30)
Avail: NTIS CSCL 08G

The luminescent and thermoluminescent properties of the separated mineral phases of a microgranite were studied and compared with those of the unseparated parent granite. It is concluded that the feldspar constituent of granite is responsible for the observed thermoluminescent properties of granite. The spectra obtained for the granite and all the constituent minerals are very similar, showing an enhancement towards the red end of the spectrum, characteristic of many terrestrial, meteoritic, and lunar minerals. The large increase in efficiency in the blue with reduction of temperature seen in many granites is due to the constituent quartz. Preliminary mineralogical studies of the material returned by Apollo 11 and Apollo 12 indicate that this investigation is of relative interest to transient lunar phenomena.
E.M.C.

N71-10087*# Pau Univ. (France).
LABORATORY STUDIES OF LUMINESCENCE OF ROCKS AND OF NATURAL AND SYNTHETIC INORGANIC MATERIALS
J. Dubois *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 pp 99-104 refs (See N71-10076 01-30)
Avail: NTIS CSCL 08G

Two methods for investigating the luminescence of various inorganic materials are proposed: measurements of Fraunhofer line depth, and measurement of excess light superimposed upon a continuous spectrum background. Luminescence was detected for several rocks using the Fraunhofer line depth method. Rocks are often very absorbent in some spectral bands, but short wavelength radiation can penetrate for some distance and excite luminescence. Luminescence can be studied even if the luminescent matter is mixed with nonluminescent material of weak albedo. However, it was proved that light absorption of inactive and thin substances can distort luminescence bands.
E.M.C.

N71-10149# Royal Radar Establishment, Malvern (England).
STUDY OF THE LOWER IONOSPHERE BY INCOHERENT SCATTER RADAR
G. N. Taylor *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The electron concentration between 60 and 140 km, including the upper D-region and E-region of the ionosphere are reported, after a brief discussion of the modification in design of the receiver for the RRE 43 m fixed aerial. Results are graphed showing electron concentration versus height.
F.O.S.

N71-10150# Royal Radar Establishment, Malvern (England).
IONOSPHERIC TEMPERATURE MEASUREMENTS
J. B. G. Roberts *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The measurement of ion and electron temperature at altitudes from 180 to 850 km by determining the shape of the Doppler broadening function of the scattered radar signal is reported. It was found that the electron temperature usually exceeds that of the ions and is more variable.
F.O.S.

N71-10176# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 5TH ANNUAL CONFERENCE ON

ATMOSPHERIC CONTAMINATION IN CONFINED SPACES
Dec. 1969 277 p refs Conf. held at Dayton, Ohio, 16–18 Sep. 1969
(AD-709994; AMRL-TR-69-130) Avail: NTIS CSCL 6/20

This report is a compilation of the papers presented and the Proceedings of the Conference. Major technical areas discussed included toxicological evaluation of atmospheres and contaminants, evaluation of propellant toxicity, histopathological evidences of toxicity, and detection and characterization of contaminants.
Author (TAB)

N71-10192# Danish Meteorological Inst., Charlottenlund.
OCEANOGRAPHICAL OBSERVATIONS FROM DANISH LIGHT-VESSELS AND COASTAL STATIONS [OCEANOGRAFISKE OBSERVATIONER FRA DANSKE FYRSKIBE OG KYSTSTATIONER]
1969 178 p In ENGLISH and DANISH
Avail: NTIS

In addition to oceanographical observations, observations are given for the direction, height, and period of the waves together with synoptic meteorological observations. Temperature and salinity measurements are also given. Information is given in tabular form with meteorological charts given for each month.
E.H.W.

N71-10228# Royal Radar Establishment, Malvern (England).
SIMULTANEOUS TOP-SIDE SOUNDER AND INCOHERENT SCATTER MEASUREMENTS IN THE IONOSPHERIC F-REGION
G. N. Taylor *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p ref (See N71-10201 01-34)
Copyright. Avail: NTIS

A high power upper atmosphere radar measures electron concentration and electron and ion temperatures in the F-region. These quantities are also measured by a number of scientific satellites moving through the ionosphere. The purpose is, firstly, to compare profiles of electron concentration vs altitude obtained by the two methods, in order to search for systematic errors in either technique, and secondly to obtain more information about the ionospheric plasma than either method will yield on its own.
Author

N71-10229# Royal Radar Establishment, Malvern (England).
INTERNAL GRAVITY WAVES IN THE UPPER ATMOSPHERE
G. N. Taylor and J. B. G. Roberts *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Properties of internal gravity waves are discussed as well as ionospheric F-region measurements. The experimental data, consisting of curves of electron concentration against time at five separate heights between 200 and 715 km, are shown. These curves show irregular variations with periods from about 20 minutes upwards. It can be seen that the variations at 715, 515, and 350 km are well correlated, with zero time shift. Below 350 km, the pattern is displaced in time and considerably decorrelated. The maximum in electron concentration vs height profile (the F-peak) occurs just above 250 km throughout the time interval of the data.
Author

N71-10246*# Techtran Corp., Glen Burnie, Md.
VELOCITY OF ORDERED MOTION OF IONOSPHERIC IONS AT AN ALTITUDE OF 600 km [SKOROST UPORYADOCHENNOGO DVIZHENIYA IVNOV V IONOSFERE NA VYSOTE 600 km]
V. N. Ponomarev Washington NASA Oct. 1970 14 p refs Transl. into ENGLISH from Kosmich. Issled (Moscow), v. 8, no. 4, 1970 p 563–570
(Contract NASw-2037)
(NASA-TT-F-13358) Avail: NTIS CSCL 04A

The results of measurements of the velocity of ordered motion of ionospheric ions at an altitude of 600 km is given. The results were obtained using a special instrument, an ion detector, during flight of the Cosmos-184 artificial earth satellite during November-December, 1967. Maps were constructed showing the distribution of the vertical and horizontal components of velocity of ion motion relative to the artificial earth satellite orbital plane and these same components of ion drift velocity relative to the earth's surface. A qualitative explanation for the results is given.
Author

N71-10277# Communications Research Centre, Ottawa (Ontario).
ALOUETTE 1 IONOSPHERIC DATA, ALOSYN, 1–30 NOVEMBER 1968
[1969] 74 p
Avail: NTIS

Alosyn is Alouette topside sounder synoptic data. It consists of selected ionospheric parameters obtained from Alouette I ionograms. The parameters are listed in the order in which the ionograms are recorded, one tabulation row for each ionogram. The parameters are tabulated for all sounder data recorded during the month at telemetry stations.
Author

N71-10278# Communications Research Centre, Ottawa (Ontario).
ALOUETTE 2 IONOSPHERIC DATA, INTERPOLATED N(h), VOLUME 1
[1969] 114 p
Avail: NTIS

The calculation of real height profiles yields electron number densities at heights which vary from profile to profile and which depend on the scaling of the ionogram. It is useful, however, to determine the number density at specific heights to study the variation in density at constant heights. The electron number density at heights from 3000 km to 250 km in increments of 50 and 200 km are tabulated for Alouette 2 ionospheric data N(h) profiles.
Author

N71-10308*# Carnegie-Mellon Univ., Pittsburgh, Pa.
MOESSBAUER SPECTROSCOPY OF COAL-RELATED MINERALS
James D. Ulmer *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 31–36 refs (See N71-10304 01-06)
Avail: NTIS CSCL 08G

Obtained Fe-57 Mossbauer spectra of various iron-containing compounds and minerals are used to identify those in coal by comparison with their Mossbauer spectra. The parameters obtained from Mossbauer spectra that are most readily used for identification of chemical compounds are the isomer shift and the quadrupole splitting. Other parameters, line width and fractional absorption, for example, can also be used to identify a compound. These parameters, however, depend not only on the nuclear and atomic configuration of iron atoms in the compound, but also on the nature of the particular sample. For example, sample thickness and concentration of iron atoms in the sample can affect line width and fractional absorption, and, therefore, these parameters are not so easily used for identification. In addition to the quadrupole splitting, Fe-57 displays a magnetic splitting in ferromagnetic materials. Observation of splitting of this nature, then, would help to identify such minerals or compounds.
Author

N71-10337*# Scientific Translation Service, Santa Barbara, Calif.
ON THE RELATION BETWEEN ELASTIC AND OPTICAL ANISOTROPY
Junzo Kasahara et al Washington NASA Nov. 1970 19 p refs Transl. into ENGLISH from Jishin (Tokyo), v. 21, 1968 p 176–187
(Contract NASw-2035)
(NASA-TT-F-13324) Avail: NTIS CSCL 08G

The relationship between the elastic and the optical anisotropy

was studied for silicates and a few other minerals. It was found for silicates that in the direction of the large refractive index, the longitudinal wave velocity is larger and the linear compressibility is smaller, and in the direction of the small refractive index, the longitudinal wave velocity is smaller and the linear compressibility is larger. This relation is represented by the empirical formula that Delta V = 67 Delta N km/s and the anisotropy on the linear compressibility is 12.5 Delta N, where Delta N is double refraction and Delta V is the value of the anisotropy on the longitudinal wave velocity. However the relationship of Delta V to Delta N is considerably different from the relationship between the mean longitudinal wave velocity and the mean optical refractive index: dV/dN = 19.5 km/s. Author

N71-10338*# Scientific Translation Service, Santa Barbara, Calif.
PHASE TRANSITION HYPOTHESIS FOR THE EARTHQUAKE OCCURRENCE. PART 1: OBSERVATION OF ELASTIC SHOCKS DURING TRANSITION OF AMMONIUM FLUORIDE
J. Kasahara et al Washington NASA Nov. 1970 12 p refs Transl. into ENGLISH from Jishin (Tokyo), v. 22, 1969 p 201-208
(Contract NASw-2035)
(NASA-TT-F-13325) Avail: NTIS CSCL 08K

When a crystal structure of ammonium flouride, NH4F, reversibly transforms from Wurtzite structure to NaCl structure at ca. 4 kb, a number of small elastic shocks is accompanied with the volume change by the rapid phase transition. These shocks are also generated during the lowering pressure run, where NaCl corresponds to a phase transition in a small volume in the specimen, the amount of the reactant is given by the accumulated number of shocks. Fitting the bulk rate of the phase transition by the equation of the rate theory; dX/dt = K(1-X) to the p power, where X is the mole fraction of the reactant at the time t, we obtain p = 1 and K = 0.1/sec. The present result shows that the phase transition is the first order reaction, and the bulk rate of the phase transition is in the order of 0.1/sec, although the process of the phase transition is not continuous but is the superposition of very rapid ones with elastic wave radiation. Author

N71-10348*# East Tennessee State Univ., Johnson City. Remote Sensing Inst.
THE FEASIBILITY OF USING REMOTE SENSORS FOR GEOGRAPHIC RESEARCH Final Report
Robert W. Peplies May 1970 74 p refs Sponsored by NASA
(Contract N00014-67-A-0102-0001)
(NASA-CR-111109; AD-707815; FR-1) Avail: NTIS CSCL 08F

The project had as its purpose the evaluation of remote sensor returns for use as data sources for geographic research. Test site 46, which is a 50 mile long, 10 mile wide strip oriented generally northwest-southeast from the Tennessee-North Carolina state line near Hot Springs, over Asheville, to the vicinity of Hendersonville near the North Carolina-South Carolina state line, was established as a region for periodic sampling by remote sensors and subsequently evaluating the utility of using such returns as data sources or contributory information sources for solution of certain geographic problems. Author (TAB)

N71-10351*# Scientific Translation Service, Santa Barbara, Calif.
IRARSITE: A NEW SULFOARSENIDE OF IRIDIUM, RHODIUM, RUTHENIUM AND PLATINUM [IRARSIT: NOVYY SUL'FOARSENID IRIDIYA, RODIYA, RUTENIYA I PLATINY]
A. D. Genkin et al Washington NASA Nov. 1970 21 p refs Transl. into ENGLISH from Vses. Mineralog. Obshchestvo, Zapiski (USSR), v. 95, 1966 p 700-712
(Contract NASw-2035)
(NASA-TT-F-13357) Avail: NTIS CSCL 08G

Studies of platinum deposits revealed a new metal of the platinum group, irarsite and ruthenic hollingworthite. The reflectivity of irarsite is 46.1% and that of ruthenic hollingworthite is 49.1%. Both are isotropic, have cubic syngony, and belong to the structural group of pyrite. Author

N71-10354*# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
PASSIVE MICROWAVE OBSERVATIONS OVER THE OCEANS
Lee Umphress Martin (M.S. Thesis) Aug. 1970 99 p refs
(Grant NGR-48-002-009)
(NASA-CR-111105) Avail: NTIS CSCL 08C

The predicted brightness temperatures that would be observed using several theoretical models of the ocean surface and atmosphere is investigated. Using the models, the predicted brightness temperatures are used to provide information about the following parameters: height of sensor, atmospheric effects, angular dependence of signal, surface roughness, surface films or slicks, foam and whitecaps. Real atmospheric profiles of temperature and relative humidity are used to calculate brightness temperatures for comparison to observed microwave observations over the oceans taken with a scanning radiometer at 19.35 GHz. Actual data used are from flights over the Pacific Ocean, the Gulf of Mexico and the Salton Sea. Conclusions are reached about the current theories of atmospheric and surface parameters and recommendations are made regarding possible modifications to the current roughness models of the ocean surface. Author

N71-10400# National Council on Marine Resources and Engineering Development, Washington, D.C.
MARINE SCIENCE AFFAIRS: SELECTING PRIORITY PROGRAMS Annual Report
Apr. 1970 298 p refs
Avail: Issuing Activity

The annual report of the President of the United States on marine resources and engineering development is presented. The report sets forth the priorities of the U.S. marine science program and describes the approved activities for 1971. Estimates are given for the funding requirements of each government agency engaged in marine science activities during the fiscal year. R.B.

N71-10402# Lowell Technological Inst. Research Foundation, Mass.
INVESTIGATION OF THE TURBULENT AND DRIFT MOTIONS IN THE IONOSPHERE Final Report, 1 Jan. 1967 - 30 Sep. 1969
Klaus Bibl and James E. Gorman May 1970 46 p refs
(Contract F19628-67-C-0168)
(AD-710701; LTIRF-315/IP; AFCRL-70-0259) Avail: NTIS CSCL 4/1

The report describes the continuing operation of the Ionospheric Drift System at Billerica, Massachusetts. It contains an up-to-date tabulation of the stored data. The data is recorded on analog tape at the field station, then re-recorded in digital form at Lowell Technological Institute Research Foundation for computer analysis. During this process, interesting, unusual, or faulty records are noted and instructions prepared for amplitude and phase calibrations. Modification of the original drift system permits direct digital recording of data in a new format such that the original tapes may be computer analyzed without further data formatting. In addition, the data format of the modified system provides for multiple frequency operation with four receiving antennas instead of the three previously used. Author (TAB)

N71-10412*# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
LIGHTNING HAZARD TO ROCKETS DURING LAUNCH 1
Heinz W. Kasemir Dec. 1969 11 p Sponsored by NASA
(NASA-CR-111118; ESSA-TR-ERL-143-APCL-11) Avail: NTIS CSCL 04A

The problems involved in launching a rocket through thunder shower clouds are discussed. The problem of the rocket generating its own lightning in strong electric fields inside clouds and in clouds which do not have electric fields, is considered. A model of a tripolar thunderstorm is used to study the problem. E.H.W.

N71-10458*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.

MICROWAVE EMISSION FROM GRANULAR SILICATES: DETERMINATION OF THE ABSORPTION COEFFICIENT FROM PLATE MEASUREMENTS AND THE EFFECTS OF SCATTERING

J. E. Conel 15 Oct. 1970 23 p refs

(Contract NAS7-100)

(NASA-CR-111023; JPL-TM-33-458) Avail: NTIS CSCL 08G

Microwave brightness temperature measurements from plane layers of granulated silicate materials backed by a perfectly reflecting metal plate are used to determine the mass absorption coefficient, attenuation length, and effective values of electrical conductivity and loss tangent. The important experimental finding is that the mass absorption coefficient is independent of frequency but highly dependent on moisture content. Based on this, it can be determined that the effective conductivity increases with frequency, and that the loss tangent is independent of frequency in this frequency range. Computed values of these quantities are in rough numerical agreement with extrapolated laboratory values on other silicate materials. The effects of scattering, using elementary solutions of the equation of radiative transfer, are described. Author

N71-10460# Aerospace Corp., El Segundo, Calif. Lab. Operations.

RESEARCH ON THE EARTH'S UPPER ATMOSPHERE, JULY 1969 - APRIL 1970

David D. Elliott 31 Jul. 1970 54 p

(Contract F04701-70-C-0059)

(AD-710693; TR-0059(6260-10)-1; SAMSO-TR-70-300) Avail: NTIS CSCL 4/1

Several scientists, engineers, and technicians in The Aerospace Corporation Space Physics Laboratory have been engaged in experimental and theoretical investigations of the upper atmosphere. A short review of the present understanding of the atmosphere and some of their contributions to that knowledge are given in the report. Author (TAB)

N71-10485# Naval Research Lab., Washington, D.C.

INSTABILITIES OBSERVED IN LOWER-E-LAYER ALKALI-PLASMA-CLOUD RELEASES AND THEIR IMPLICATIONS REGARDING SPORADIC E: PROJECT SESAMISEED

John R. Davis 28 Jul. 1970 113 p refs

(AD-710742; NRL-7105) Avail: NTIS CSCL 4/1

The report describes a study of gun- and rocket-emplaced alkali plasma clouds in the 85-105 km altitude region of the ionosphere. The object of the investigation is to study the small-scale (tens-of-meters), short-term (fractions-of-seconds) irregular motion of the magnetofluid in the lower E layer. Motions on this spatial and temporal scale are known to be responsible for radiofrequency scattering at E-layer heights, and it has been suspected that they are important in the appearance and evolution of the sporadic-E layer. The resolution which is necessary to discern motions on the scale indicated was afforded by decameter- and meter-wavelength coherent-pulse-doppler radar. A survey of possible instability mechanisms which can explain the spatial and temporal scales of the irregular motion observed in Phase III of plasma cloud evolution leads to the conclusion that a dissipative instability involving crossed electric and magnetic fields in the presence of a properly oriented plasma density gradient is the most likely candidate. It is found that the observed tens-of-meters instability wavelengths and tenths-of-seconds growth times are predicted by this mechanism, and curves of these parameters are presented for various altitudes, electrostatic field intensities, and wavelengths. Author (TAB)

N71-10489# California Univ., Livermore. Lawrence Radiation Lab.

HIGH-PRESSURE MECHANICAL PROPERTIES OF TUFF FROM THE DIAMOND DUST SITE

D. R. Stephens, H. C. Heard, and R. N. Schock 22 Apr. 1970 17 p refs Sponsored in part by AEC

(UCRL-50858) Avail: NTIS

The strength, acoustic velocities and pressure-volume relationship were studied as a function of pressure for ten Area 16 tuffs near the Diamond Dust site. The results are typical for weak, wet tuffs. The shear strengths are low, 100-400 bars, and show moderate variation with pressure. Acoustic velocities are low, and high-frequency waves are severely attenuated. The tuffs are very compressible and show collapse of gas-filled voids at 1 kb or less. Phase transformations due to water are apparent at 10-12 and 22-25 kb. Author

N71-10516# Space Disturbances Lab., Boulder, Colo.

LONG-RANGE FORECAST OF GEOMAGNETIC ACTIVITY: 1970 - 1973

R. H. Olson Jul. 1969 14 p refs

(ESSA-TR-ERL-160-SDL-13) Avail: SOD $0.25

A statistical analysis is made of geomagnetic and auroral data over the last eight sunspot cycles. It is shown that the maximum in geomagnetic-auroral activity lags behind the sunspot maximum by 2-3 years. Taking into account this lag relationship, and the semiannual wave in geomagnetic activity, it is possible to extrapolate ahead for the next four years and predict monthly averages of A sub p and number of occurrences per month of A sub p > or = to 30. The predictions could also be used as indicators of future auroral activity. Author

N71-10529# Naval Postgraduate School, Monterey, Calif.

SOME CHARACTERISTICS OF TEMPERATURE MICROSTRUCTURE IN THE OCEAN

Peyton Marshall Magruder, Jr. (M.S. Thesis) Apr. 1970 156 p refs

(AD-710714) Avail: NTIS CSCL 8/10

The background of microstructure and its effects on sound propagation is reviewed. The expendable bathythermograph (XBT) system and current digitizing procedures are evaluated to determine their adequacy in investigating vertical thermal microstructure. Several methods of microthermal analysis are proposed. Temperature gradient versus depth plots are used to analyze data from several ocean regions - Atlantic Coastal, Andaman Sea, Eastern North Pacific, and the northern boundary of the Gulf Stream. Analysis of these data suggest a water mass dependence of the thermal microstructure. The significance of the small-scale structure to Naval operations is discussed. Author (TAB)

N71-10547# Naval Postgraduate School, Monterey, Calif.

CNOIDAL WAVE THEORY APPLIED TO RADIATION STRESS PHENOMENA

George Meredith Musick, III (M.S. Thesis) Apr. 1970 50 p refs

(AD-710715) Avail: NTIS CSCL 8/3

A simplified hyperbolic approximation to cnoidal wave theory is applied to generate the radiation stress tensor and used in the equations of motion to obtain solutions for changes in the mean water level outside and inside the surf zone. Comparison between linear theory, cnoidal theory and laboratory results are made. A limiting case and an optimum case for cnoidal theory are discussed in the comparison. Cnoidal theory is shown to give better predictions than linear theory to the data considered. Author (TAB)

N71-10556# Naval Research Lab., Washington, D.C.

OBSERVATIONS OF VISIBLE SHOCK WAVES IN THE ATMOSPHERE Selected Articles

M. A. Kuznetsov et al 12 Aug. 1970 11 p refs Transl. into ENGLISH from Priroda (Moscow), v. 36, no. 7, 1947 p 90-91

v. 37, no. 3, 1948 p 92–93 v. 38, no. 2, 1949 p 81 v. 38, no. 10, 1949 p 94–95
(AD-711123; NRL-Trans-1209) Avail: NTIS CSCL 4/1

The report presents eye-witness reports on the propagation of atmospheric shock waves. TAB

N71-10587 Lockheed Missiles and Space Co., Palo Alto, Calif.
MEASUREMENT OF THE DIURNAL GLOW OF THE ATMOSPHERE IN THE 1800–6000 A RANGE ON THE 'KOSMOS-224'
V. A. Krasnopolskii [1970] 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 10, no. 4, 1970 p 637–642
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Filter measurements of the brightness of the glow of the atmosphere near the horizon have shown that aerosol scattering plays an insignificant part in the diurnal glow of the atmosphere at altitudes above 130 km. The diurnal behavior of the glow is characterized by the dependence cos Z (Z is the sun's zenith angle). The cloudiness structure is not inherent to the glow of the day sky. Zenith intensities are presented for individual glow components. At night the glow of the atmosphere does not exceed 100 R in the 1800–6000 A range at altitudes greater than 130 km. Author

N71-10605*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROVISIONAL HOURLY VALUES OF EQUATORIAL Dst, JANUARY–JUNE 1970
M. Sugiura and D. J. Poros Nov. 1970 10 p
(NASA-TM-X-65380; X-645-70-405) Avail: NTIS CSCL 08N

Tables of hourly values of Dst given are based on two observatories; Honolulu and San Juan, and are only provisional. Author

N71-10611*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
A LOW-ALTITUDE SATELLITE INTERACTION STUDY (NEUTRAL GASES) Final Report
R. R. McKinley, G. K. Bienkowski, and S. M. Siskind 20 Oct. 1970 52 p refs
(Contract NAS5-11241)
(NASA-CR-111136; AED-R-3635-F) Avail: NTIS CSCL 04A

The work done on a Monte Carlo numerical computer technique for describing the interaction of the flow-field with a spacecraft in the so-called transitional flow regime is documented. An existing two-dimensional, two-fluid computer program was converted to a more general three-dimensional program capable of accommodating realistic satellite geometries. The program was coupled to a previously existing program for determining conditions in a cavity within a satellite moving in the transitional region. The new programs were tested using realistic data and a realistic satellite geometry, and the possibilities of constructing a computer program capable of handling three different species of gas rather than two were examined. The resultant, state-of-the-art computer programs are discussed, and the results obtained from investigating the Atmosphere Explorer spacecraft geometry over the range of conditions expected in the 90 to 150 kilometer region of the atmosphere are given. Author

N71-10625# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHY OF THE WEDDELL SEA IN 1969 (WSOE), FEBRUARY–MARCH 1969
Gary L. Hufford and James M. Seebrooke Feb. 1970 36 p refs
(CG-373-31; Rept-31) Avail: NTIS

The physical oceanography of the Weddell Sea during the austral summer of 1969 is discussed. The work was done on the icebreaker USCGC GLACIER (WAGB-4) as part of the second phase of the International Weddell Sea Oceanographic Expedition. Temperature, salinity, and oxygen measurements were obtained from a salinity-temperature-depth recorder and from Nansen bottles. Author

N71-10687# Naval Research Lab., Washington, D.C.
A GLOSSARY OF WORLD BATHYMETRIC TERMS AND THEIR ENGLISH LANGUAGE EQUIVALENTS
Norman Z. Cherkis 31 Jul. 1970 30 p refs
(AD-710992; NRL-7094) Avail: NTIS CSCL 8/10

A two-part glossary of bathymetric feature terms in 27 languages was compiled to aid users of bathymetric charts in other than their native languages. Thirty-eight features, recognized by the U. S. Board on Geographic Names (Advisory Committee on Undersea Features), are listed. Author (TAB)

N71-10721# Stanford Univ., Calif. Radioscience Lab.
A WHISTLER STUDY OF THE INTERCHANGE OF IONIZATION BETWEEN THE IONOSPHERE AND THE PROTONOSPHERE
C. G. Park Aug. 1970 78 p refs
(Grants NSF GA-775; NSF GA-10719; NSF GA-1151; NSF GA-1485)
(SU-SEL-70-022; TR-3442-1) Avail: Issuing Activity

A detailed whistler study of the electron content of protonospheric tubes of ionization is presented. The accuracy with which the measurements can be made permits determination of the net interchange between the F-region and the protonosphere. The results of flux measurements and their implications are discussed. The behavior of the protonosphere and the ionosphere during disturbed periods is described. Possible implications of the observed coupling fluxes and the observed stormtime behavior of the protonosphere for the questions of abundance and distribution of light gases in the earth's atmosphere are reported. Author

N71-10724*# Oregon State Univ., Corvallis. Dept. of Oceanography.
RESEARCH ACTIVITIES Progress Report, 1 Apr.–30 Sep. 1969
Beverly Knapp, ed. Nov. 1969 101 p refs Sponsored in part by AEC, PHS, Dept. of Interior, Geol. Surv., Dept. of Com. and NSF
(Grant NGR-38-002-013; Contracts AF 49(638)-1043; NOOO14-67-A-0369-0007; NOOO14-67-A-0369-0001; NOOO14-68-A-0148)
(NASA-CR-111122; AD-699960; PR-24) Avail: NTIS CSCL 8/A

Contents: Physical oceanography; Geological oceanography; Geophysical oceanography; Chemical oceanography; Radiochemistry - radioecology; and Biological oceanography. TAB

N71-10735# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICING OCCURRENCE, CONTROL AND PREVENTION. AN ANNOTATED BIBLIOGRAPHY
Kevin L. Carey Jul. 1970 61 p refs
(AD-711534; CRREL-SR-151) Avail: NTIS CSCL 8/12

Icings present severe problems for highways, railroads, airfields, and structures. Details of icing processes, and past and present practices of icing prevention and control, are given in annotations for 93 of 94 bibliographic entries. The entries were selected from over 200 references examined through March 1968. Of the 94 entries, 51 are from the Soviet Union, 37 from the United States, and 6 from Canada. Fourteen recent Russian papers were translated specifically for this study. Author (TAB)

N71-10783*# California Univ., Berkeley. Space Sciences Lab.
INTEGRAL EQUATION FORMULATIONS OF SCATTERING FROM TWO-DIMENSIONAL INHOMOGENEITIES IN A

CONDUCTIVE EARTH, PART 1 Final Report
John Robert Parry Aug. 1969 216 p refs *Its* Space Sci. Lab. Ser. 11, Issue 46
(Contract NAS2-5078)
(NASA-CR-110910) Avail: NTIS CSCL 08N

The electromagnetic fields scattered by finitely conducting cylinders of arbitrary cross section in a conductive half-space with an arbitrary earth-air profile are calculated. The problem is formulated by choosing an integral representation for the electromagnetic fields in each homogeneous region present. The validity and accuracy of the integral equations are demonstrated by comparing numerical results with analytical results for scattering from circular cylinders in a conductive whole-space assuming plane wave and line source incident fields. It is shown that three-dimensional source configurations can be considered by expanding the primary current distribution and the field it radiates into a Fourier integral over a continuous mode distribution. Author

N71-10784*# California Univ., Berkeley. Space Sciences Lab.
INTEGRAL EQUATION FORMULATIONS OF SCATTERING FROM TWO-DIMENSIONAL INHOMOGENEITIES IN A CONDUCTIVE EARTH, PART 2 Final Report
John Robert Parry Aug. 1969 183 p refs *Its* Space Sci. Lab. Ser. 11, Issue 47
(Contract NAS2-5078)
(NASA-CR-110911) Avail: NTIS CSCL 08N
For abstract, see N71-10783.

N71-10791# Coast and Geodetic Survey, Washington, D.C.
TIDE TABLES, HIGH AND LOW WATER PREDICTIONS, 1971: EAST COAST OF NORTH AND SOUTH AMERICA INCLUDING GREENLAND
Jan. 1970 290 p refs
Avail: Coast and Geodetic Survey, Washington, D.C.: $2.00

Tables are given for the daily predictions for 48 reference stations and differences for 2,000 stations in North and South America. It contains also a table for obtaining the approximate height of the tide at any time, a table of local mean time of sunrise and sunset for every fifth day of the year for different latitudes, a table for the reduction of local mean time to standard time, a table of moonrise and moonset for 8 places, and a table of the Greenwich mean time of the moon's phases, apogee, perigee, greatest north and south and zero declination, and the time of the solar equinoxes and solstices. Author

N71-10792*# Kansas Univ., Lawrence. Center for Research.
GEOLOGIC EVALUATION OF RADAR IMAGERY FROM DARIEN PROVINCE, PANAMA
Harold C. MacDonald 1 Jun. 1969 139 p refs
(Contracts NAS9-7175; DAAK02-68-C-0089; ARPA Order-1079)
(NASA-CR-111124; AD-698346; CRES-TR-133-6) Avail: NTIS CSCL 08G

The primary objectives of this study were to (1) determine the utility of radar in the compilation of geological reconnaissance maps, (2) define and analyze radar-linears (joint systems and faults) and infer the nature of the tectonic forces responsible for certain types of local structures, (3) examine the effect of radar look-direction (direction orthogonal to ground track of the aircraft) and determine if there is a factor of directional dependency with radar systems, and (4) evaluate the potential of radar as a single geological reconnaissance tool in the tropical environment and what application these imaging systems may possess for future geological reconnaissance surveys in similar geographic areas. Author (TAB)

N71-10801# Joint Publications Research Service, Washington, D.C.
APPLICATIONS OF SPACE PHOTOGRAPHY IN GEOLOGY
B. V. Vinogradov et al 15 Oct. 1970 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (Moscow), no. 1, 1970 p 16–27
(JPRS-51578) Avail: NTIS

Comparative analyses of space photography at a 1:2,000,000 scale and geological maps of Morocco, New Mexico, Arizona, Libya, Tibet, and the high lands of the Sahara are summarized. The effects of vegetation and meteorological conditions on the photointerpretation of geological features in space photographs are discussed as well as the advantages and disadvantages of both aerial and space photography. The analysis of sedimentary, metamorphic, and igneous rock compositions is cited, based on space photography. The use of space photography in studying tectonic structures is mentioned along with suggestions for its use in studies of other geological structures. J.M.

N71-10804# Coast and Geodetic Survey, Washington, D.C.
TIDE TABLES: HIGH AND LOW WATER PREDICTIONS, 1971. WEST COAST OF NORTH AND SOUTH AMERICA, INCLUDING THE HAWAIIAN ISLANDS
1970 225 p
Avail: Coast and Geodetic Survey, Washington, D.C.: $2.00

The tables contain full daily predictions for 38 reference ports and differences and other constants for about 1,100 stations in North America, South America, and the Hawaiian Islands. Tables for obtaining the approximate height of the tide at any time, local mean time of sunrise and sunset for every fifth day of the year for different latitudes, moonrise and moonset for 6 places, and the Greenwich mean time of the moon's phases, apogee, perigee, greatest north and south and zero declination, and the time of the solar equinoxes and solstices are given. Author

N71-10807# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATION RELATIVE TO CARTOGRAPHY AND SURVEYING. SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION, NO. 48 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN, HEFT NR. 48]
1970 42 p refs In GERMAN; ENGLISH summary
Avail: NTIS

Determined is the geoid on the basis of deflections of the vertical in the system of the Reichsdreiecksnetz based on Bessel's ellipsoid. Computations are made by interpolation according to the least squares method. Described are fundamentals and results of geoid determinations. Author

N71-10808# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATION RELATIVE TO CARTOGRAPHY AND SURVEYING. SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION. NO. 44 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN, HEFT NR. 44]
1970 76 p refs In GERMAN; ENGLISH summary Submitted for publication
Avail: NTIS

Described are the working methods in evaluating satellite photographs by the astrometric procedure. Two details, automatic identification automatic of stars and the approximation of ideal image coordinates, are illustrated by means of arithmetical examples. Author

N71-10838*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOPAUSE ATTITUDES DURING OGO-5 CROSSINGS
B. G. Ledley Oct. 1970 20 p refs Submitted for publication
(NASA-TM-X-65378; X-645-70-399) Avail: NTIS CSCL 04A

The magnetopause crossings of the Fifth Orbiting Geophysical Observatory (OGO-5) are reported, using data taken by the Goddard

Space Flight Center magnetic field experiment which measures field components with a resolution of 1/4 gamma. The sampling rate of the three components is 1.7, 14, or 56 samples per second, depending on the mode of operation of the observatory. A total of 70 crossings were examined, of which 31 satisfied accuracy criteria of the calculation. These crossings were located at subsatellite local times between 1020 and 0430, and solar magnetospheric latitudes between −7 deg and +40 deg. Author

N71-10848# New York Univ., N.Y. Geophysical Sciences Lab.
THE THEORY OF WAVE REFRACTION IN SHOALING WATER, INCLUDING THE EFFECTS OF CAUSTICS AND THE SPHERICAL EARTH
Yung-Yao Chao Jun. 1970 80 p refs
(Contracts N62306-67-C-0124; N62306-70-A-0075)
(AD-711304; GSL-TR-70-7) Avail: NTIS CSCL 8/3

The existing wave refraction theory for surface water waves fails to predict wave behavior at and near a caustic. It is also inadequate for computing ray paths and refraction coefficients for waves traveling over large expanses of shoaling water. In the vicinity of a caustic, ray crossings occur, and the wave amplitude, according to existing theory, becomes infinite. This is, of course, devoid of physical meaning. The conventional equations for the ray path and ray separation are derived in Cartesian coordinates and therefore are valid only for a relatively small area of the ocean that can be considered as a plane surface. It is expected that considerable error in the ray patterns will occur if these equations are used for larger areas in which the curvature of the earth plays an important role. In order to overcome the first difficulty, the linearized wave equations were first modified in such a way that the bottom slope was taken into account. To solve the second problem, Fermats principle was applied directly to the spherical polar coordinate system and the equations for the ray path and ray separation were derived in terms of latitude and longitude. TAB

N71-10849# RAND Corp., Santa Monica, Calif.
TIDAL WINDS IN THE LOWER IONOSPHERE
E. S. Batten Aug. 1970 17 p refs Presented at 1970 Symp. on Upper Atmospheric Currents and Elec. Fields, Boulder, Colo., 12-21 Aug. 1970
(AD-711782; P-4435) Avail: NTIS CSCL 4/1

Many ionospheric phenomena are coupled to the neutral air motions. In particular, tidal motions in the E-region are considered to be the source of the solar daily variation (Sq) of the geomagnetic field. Moreover, the electric fields produced by the tidal motions may affect the morphology of the F-layer. Thus a description of the tidal winds in the E-region is desirable. However, observations of winds, primarily from meteor-trail and vapor-trail drifts, are available at only a few locations and, in the case of vapor trails, only during the night hours. Further, the interpretation of these observations have produced an inconsistent description of the tides. Therefore, to improve the description of neutral air motions in the E-layer, tidal winds have been computed from theory. To do this, the effects of dissipation and thermal excitation in the thermosphere are considered. Possible forms of dissipation are molecular heat conduction and viscosity, turbulence, and ion drag. Thermospheric excitation may be due to heating by absorption of solar radiation, particle precipitation, and dissipative mechanisms. In this paper, the effects of heat conductivity and the absorption of solar radiation in the thermosphere are added to the existing tidal theory. Author (TAB)

N71-10877# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
OZONE AND HYDROGEN REACTIONS
M. Nicolet 10 Mar. 1970 55 p refs
(Grant NSF GP-5611)
(PB-191048; SR-350) Avail: NTIS

The report discusses and reviews the dissociation of H2O in the stratosphere and lower mesosphere which is brought about mainly by a collision process with excited oxygen atoms produced by photodissociation of ozone. The rate of oxidizing processes falls off more rapidly with increase of altitude than does that of the vertical transport by eddy diffusion. Hydrogen molecules in the mesosphere are produced as a result of subsequent chemical reactions between hydroperoxyl radicals and hydrogen atoms and causes the ozone concentration to diminish pronouncedly in the mesosphere. The vertical distribution of water vapor is not affected in the stratosphere and mesosphere by the dissociation process since its reformation is rapid. Various reactions involving nitric oxide and nitrogen peroxide must be introduced in the reactions of the stratosphere. USGRDR

N71-10887# Illinois Univ., Urbana, Dept. of Civil Engineering
EARTHQUAKE ENGINEERING RESEARCH DIGEST, 1970
N. Norby Nielsen, comp. Jun. 1970 123 p
(Grant NSF GK-1757)
(PB-193507) Avail: NTIS CSCL 08K

The purpose of the research digest is to facilitate an exchange of information among researchers in earthquake engineering. The present edition contains research digests from the US, Canada, and Mexico. The survey was made by means of a questionnaire sent to more than 250 individuals in the USA, Canada and Mexico who were thought to be active in earthquake engineering research. The respondents to the questionnaire were requested to supply the title of the research program, supporting agency, a list of all investigators, a brief description of the project, and a list of publications resulting from the research project. Author (USGRDR)

N71-10888# Ohio State Univ., Columbus. Dept. of Geodetic Science.
AN ALGORITHM FOR GRIDDING SATELLITE PHOTOGRAPHS Final Report
Lee U. Bender Apr. 1970 165 p refs
(Contract DI-14-08-0001-11996)
(PB-193314; DGS-135; USGA-TD-70-004) Avail: NTIS CSCL 08B

The report includes a computer program written in FORTRAN 4 (G) for the IBM 360/65. Its purpose is to compute photo coordinates of automatically selected UTM or geographic ground coordinates. Camera inner orientation need not be known, and first approximations to outer orientation need not be supplied. Author (USGRDR)

N71-10901# Directorate of Scientific Information Services, Ottawa (Ontario).
DETERMINATION OF THE EARTH'S GRAVITY POTENTIAL ON THE GEOID
I. F. Monin Jul. 1970 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk UKR. RSR, Ser. B. (Kiev), no. 8, 1967 p 691-695
(AD-711265) Avail: NTIS CSCL 8/5

The study of the Earths figure (the geoid) on the basis of the Stokes theorem has been beset with difficulties due to the fact that to use this theorem it is necessary to postulate some hypothesis on the structure (density stratification) of the Earths interior. In 1945 M.S. Molodenski put forward a new principle for study of the geoid, requiring no hypothesis on the Earths internal structure. The geodetic gravimetry approach originated in the research of N.K. Migal and in particular of I.A. Kazanski (1932), which in turn was based on the work of Vening Meinesz. The present paper is a continuation of previous work by Monin which is available in English translation. Author (TAB)

N71-10837# Admiralty Research Lab., Teddington (England).
FLOW-INDUCED HYDROPHONE VIBRATIONS AND THE MONITORING OF TIDAL AND WAVE MOTIONS

D. E. Weston and J. Revie Feb. 1970 10 p refs
(AD-711518; ARL/L/N201; NSTIC-26989) Copyright. Avail: NTIS CSCL 8/3

Water flow past a certain bottom-laid hydrophone can excite vibrations which are sharply peaked in frequency at 4.5 Hz. The strength of the resulting electrical signal can sometimes be an embarrassment. The hydrophone signal has also been used to monitor the tidal flow, the horizontal particle motion due to surface waves, and the horizontal particle motion due to short-period internal waves. Author (TAB)

N71-10955# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
VARIABILITY AND SCATTERING PROPERTIES OF THE STRATOSPHERIC AEROSOLS
Theodore John Pepin Jul. 1970 18 p refs
(Contract N00014-67-A-0113-0004)
(AD-711682; AP-34) Avail: NTIS CSCL 4/1

Data is presented from balloon flights which shows the variability of the stratospheric aerosols during the period from 1965 to 1968 and gives evidence for their apparent systematic change with time. A study of the scattering properties of these aerosols has been made and the change in the size parameter with time is presented. Author (TAB)

N71-10971*# Stanford Univ., Calif. Radioscience Lab.
ANALYTICAL AND NUMERICAL TREATMENT OF WAVE-PROPOGATION IN THE LOWER IONOSPHERE
R. R. Scarabucci Aug. 1969 102 p refs
(Grants NGR-05-020-008; AF-AFOSR-0783-67; NSF GP-948)
(NASA-CR-111125; AD-700067; SU-SEL-69-046; AFOSR-70-0167TR; TR-3412-11) Avail: NTIS CSCL 20N

The purpose of the report is to discuss the equations controlling the propagation of waves in the lower region of the ionosphere. The first part of the report deals with the analytical treatment of the wave equations governing reflection and transmission of waves through a planarly stratified ionosphere. The mathematical treatment includes the effect of positive and negative ions. The computer program for integrating the corresponding wave equations is given. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-10011*# Perkin-Elmer Corp., Norwalk, Conn.
A PERISTALTIC ACTION MICROINCH ACTUATOR Research and Development Study
Carlo LaFiandra Washington NASA Sep. 1970 123 p refs
(Contract NAS12-2012)
(NASA-CR-1658) Avail: NTIS CSCL 20F

Microinch actuator technology and hardware capable of meeting the stringent requirements for either a segmented or a deformable active-optics space-qualified mirror system were developed. A working peristaltic microinch actuator, and advanced actuator technology were demonstrated. The various theories and models explaining the basis of operation of the actuator, the actuator itself, and the tests performed are described. Author

N71-10025*# Oklahoma Univ., Norman.
AN IMPROVED ULTRAVIOLET INTERFEROMETER
Richard A. Day Washington NASA Oct. 1970 12 p ref
(Grant NGR-37-003-047)
(NASA-CR-1666) Avail: NTIS CSCL 20F

The performance of a new ultraviolet interferometer can be improved by the tilting of the plates. The conditions of optimum performance for such a configuration of the interferometer are described. Author

N71-10043*# Virginia Polytechnic Inst., Blacksburg.
A STUDY OF THE APPLICATION OF MICROWAVE TECHNIQUES TO THE MEASUREMENT OF SOLID PROPELLANT BURNING RATES Final Report
Henry L. Wood May 1970 25 p ref
(Grant NGR-47-004-024)
(NASA-CR-111797) Avail: NTIS CSCL 20F

The utilization of Doppler microwave techniques for the measurement of solid propellant burning rates was successfully demonstrated. Both high aluminum content propellants (TPH 8009) and low aluminum content propellants (BF-117) were used in the investigation. The measurement was accomplished by determination of the phase angle between microwaves incident upon the burning surface and the microwaves reflected from the burning surface back through the unburned propellant. Precise measurement of the phase angle requires a distortion-free Doppler signal which is independent of the amplitude of the microwave signals. Considerable distortion and effects of amplitude were present in all tests conducted. Accordingly, a full-bridge microwave interferometer was designed and tested in 91 rocket firings. The characteristics of the complete interferometric system, with emphasis on the operational techniques involved are reported. Author

N71-10086*# Nuclide Corp., State College, Pa.
THE LUMINOSCOPE: A NEW INSTRUMENT FOR STUDYING THE ELECTRON-STIMULATED LUMINESCENCE OF TERRESTRIAL, EXTRA-TERRESTRIAL AND SYNTHETIC MATERIALS UNDER THE MICROSCOPE
Leonard F. Herzog, Donald J. Marshall, and Richard F. Babione *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 79-98 refs (See N71-10076 01-30)
Avail: NTIS CSCL 06F

An inexpensive device designed to facilitate studies of the cathodoluminescence of minerals and other materials that results from bombarding a specimen in a vacuum chamber with energetic electrons is described. This apparatus, the Luminoscope, permits observations to be made at magnifications up to 800 using standard microscopes. The beam can be adjusted to illuminate specimen areas from 0.5 mm to 50 mm in diameter with a beam of electrons having energies up to 18,000 volts at currents of up to 0.5 mA. Thin and thick sections as well as irregularly shaped specimens and grains can be studied. Examples of applications given include: monitoring mineral separations, distinguishing between sedimentary and detrital igneous quartz, detecting radioactive impurities in quartz, studying shock-disordering of plagioclase in lunar rocks, determining the degree of perfection of synthetic mineral crystals, studying oxidation/reduction in flame-grown crystals, fingerprinting gems, and tracing the origin of prehistoric pottery. Author

N71-10205# Royal Radar Establishment, Malvern (England).
AN AUTOMATED INFRA-RED SPECTROMETER
J. Payne *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p ref (See N71-10201 01-34)
Copyright. Avail: NTIS

An automated infrared spectrometer with an Ebert monochromator was used to study the magnitude and nature of various electronic energy gaps, densities and effective masses of electronic current carriers, and lattice vibration modes of solid materials. Wavelengths from 1 to 25 microns were obtained using two interchangeable diffraction gratings in first and second orders of diffraction. Absolute measurements of reflectance and transmittance were made of thin-sliced material. The output from the Golay cells was detected in phase-sensitive amplifiers. The resulting signal was

integrated for a preset interval, converted to digital form, and punched onto 8-hole paper tape, all within a series of Harwell 2000 type units. The curve fitting method was used to find the absorption properties of the solid materials. J.A.M.

N71-10206# Royal Radar Establishment, Malvern (England).
AN ABSOLUTE REFLECTOMETER FOR USE WITH SMALL SAMPLES IN THE VISIBLE AND VACUUM ULTRA-VIOLET
D. Jones, A. H. Lettington, and W. Richmond *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Reflectivity and band structure of semiconducting materials were calculated using an optical reflectometer. The essential features of the reflectometer are summarized as follows: (1) Both mirrors are movable and are used at the same angle of incidence for the specimen and reference beam positions; (2) the light focused onto the sample, and (3) the reflected and reference beams have equal path lengths, so that they can be focused onto a single small detector. For vacuum ultraviolet measurements, an automated instrument was constructed. J.A.M.

N71-10209# Royal Radar Establishment, Malvern (England).
INFRA-RED VISIBLE IMAGE UP-CONVERSION
J. Warner *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Conversion of image data from 10.6 micrometers to the visible spectra is reviewed. A silhouette transparency was illuminated by an extended source of 10.6 micrometers radiation derived from a carbon dioxide laser. Light at the sum frequency was produced by pumping the crystal with intense red light from a ruby laser allowing the infrared and ruby laser lights to mix. Theoretical studies were carried out on characteristic performance figures for image up-conversion, and a critical comparison was also completed. J.A.M.

N71-10210# Royal Radar Establishment, Malvern (England).
PYROELECTRIC IMAGING SYSTEMS
E. H. Putley *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

A pyroelectric detector is compared to a cooled photoconductive detector. Thermographs using a slow thermistor bolometer detector and thermal imaging systems using a single element detector combined with an opto-mechanical scanning system are discussed. Two readout mechanisms are being considered involving two dimensional arrays of integrated circuit amplifiers and TGS and other pyroelectric materials as insulators. J.A.M.

N71-10272*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VERY HIGH TEMPERATURE PERMEAMETER
John P. Barranger 20 Nov. 1970 6 p refs Presented at the 16th Ann. Conf. on Magnetism and Magnetic Mater., Miami Beach, Fla. 17–20 Nov. 1970
(NASA-TM-X-52901) Avail: NTIS CSCL 14B

A new permeameter measures the magnetizing force and the corresponding magnetic induction up to the temperature of 1000 C in a vacuum or an inert atmosphere. Two massive symmetrical yokes close the magnetic path around the specimen which consists of a rod of solid material or a bundle of sheet material. The yokes are made of a high temperature, soft magnetic material. A coil surrounding the specimen supplies a magnetizing force of up to 100 oersteds and a separate coil is used to measure the magnetic induction. Auxiliary coils provide additional magnetizing force resulting in a longitudinal distribution of flux uniform to within 1%. The magnetizing force is calculated from the coil current while a fluxmeter is used for the induction. The null balance type permeameter utilizes the magnetic potentiometer principle with yoke compensating coils to cancel the effects of the reluctance of the yoke and the joint gaps. Normal induction curves as a function of temperature for the yoke material is also presented. Author

N71-10275*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND DEVELOPMENT OF A LUNAR RADIOMETER
Walter Fountain 28 Jul. 1970 42 p refs
(NASA-TM-X-64539) Avail: NTIS CSCL 17E

The design is described and a performance analysis is presented of an infrared radiometer. The radiometer is used with an astronomical telescope in the study of thermal emission from the moon. Calibration and data reduction equations are given, and an error analysis for data obtained with the system is presented. Author

N71-10312*# Carnegie-Mellon Univ., Pittsburgh, Pa.
INSTRUMENTATION
Mark Haramic *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 65–68 refs (See N71-10304 01-06)
Avail: NTIS CSCL 20F

A brief description of all equipment and plans for modifications and acquisitions is made. Only equipment not mentioned in previous reports and new modifications are described in detail. Considered are mass spectrometry, radioactivity measurement, and Mossbauer spectrometry instruments. Author

N71-10314*# Carnegie-Mellon Univ., Pittsburgh, Pa.
MASS-SPECTROMETRY
Lance P. Black and James M. Huey *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 76–82 refs (See N71-10304 01-06)
Avail: NTIS CSCL 20F

Modified and additional instrumentation for mass spectrometry includes a digital recording system and an optical pyrometer for precise control of the thermal condition of the source during isotopic ratio measurements. Satisfactory analytical techniques were developed that allowed for lead and thallium isotope analyses of low concentrations; the former uses a single filament silica-gel method, and the latter a tungsten-ribbon filament loaded with silica-gel. Neodymium and samarium isotope measurements were also performed on 5 milligram samples. G.G.

N71-10318*# Carnegie-Mellon Univ., Pittsburgh, Pa.
DESIGN AND CONSTRUCTION OF A POSITION-SENSITIVE PROPORTIONAL COUNTER
John R. Yocum, Jr. and John F. Monahan *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 106–109 refs (See N71-10304 01-06)
Avail: NTIS CSCL 18D

A position sensitive resistive proportional detector is described. In this type of proportional tube, the conductive center wire is replaced by a wire with a resistance of approximately twice the input impedance of one of the preamplifiers used with it. Author

N71-10388*# Adcole Corp., Waltham, Mass.
ELECTRONIC INSTRUMENTATION FOR SOLAR RADIATION MEASUREMENTS Final Report, 1 Feb. 1965–31 Jul. 1969
Robert S. Hills 1 Oct. 1969 189 p refs
(NASA Order S-35349-G; NASA Order S-99821-G; Contract AF 19(628)-5042)
(NASA-CR-110906; AD-700780; AFCRL-69-0450) Avail: NTIS CSCL 03B

The report describes the design, construction, test and flight use of the electronic portions of research instruments used on

rockets and satellites for the investigation of extreme solar ultraviolet radiation. These instruments include grating monochromators for measurements in the 30 - 1300 Angstrom range and proportional counter spectrometers in the 1 - 10 Angstrom range. Also described is work done on retarding potential analyzers used for analysis of environmental charged particles. All the instruments are of a telemetering type. Associated equipment used for calibration and testing of the instruments in both the laboratory and the launch phases is described. Automatic data reduction equipment was developed and used successfully. Experiments were flown on OSO and OGO satellites, and Aerobee-150 rockets. Author (TAB)

N71-10361*# Translation Consultants, Ltd., Arlington, Va.
SOME PROBLEMS IN DESIGNING RADIO INTERFEROMETERS WITH INDEPENDENT RECEPTION [NEKOTORYYE VOPROSY POSTROYENIYA RADIOINTERFEROMETROV S AVTONOMNYM PRIYEMOM]
V. A. Alekseyev et al Washington NASA Nov. 1970 16 p refs Transl. into ENGLISH from Izv. Vysshikh Vchebn. Zavedenii, Radiofiz. (Gorki), v. 13, no. 1, 1970 p 5-15
(Contract NASw-2038)
(NASA-TT-F-13382) Avail: NTIS CSCL 20F

The main principles in designing radio interferometers with independent reception are considered. Estimates of the response of interference correlometers are made when processing is in digit form using a binary code and a computer. Possible methods of realizing ratio interferometers with high resolution are given. Author

N71-10364*# Electro-Optical Systems, Inc., Pasadena, Calif.
THE REFLECTOMETER EXPERIMENT FOR APPLICATION TECHNOLOGY SATELLITE, PHASE 2 Annual Report, 1 Nov. 1967 - 1 Jan. 1969
1 Jan. 1969 87 p refs
(Contract NAS5-9669)
(NASA-CR-107063; Rept-7003-AR) Avail: NTIS CSCL 14B

A brief description is given of the reflectometer instrument; the measurement techniques for determining the sample degradation, and reduced flight data from the first year of operation. Reflective surface degradation data gathered from 18 test samples flown on the Applications Technology Satellite (ATS-3) are presented. The reflectometer instrument measures specular sample reflectivity in four spectral bands plus one broadband. The measurements cover a spectral range of 0.3 to 3 microns. The primary objective is to test, in actual space environment, the durability of selected specularly reflective surface materials to obtain data for use in equipment design. A secondary aim is to obtain data on the degradation process. Author

N71-10450# Chicago Univ., Ill. Dept. of Physics.
CONTRAST MECHANISMS IN A HIGH RESOLUTION SCANNING MICROSCOPE
A. V. Crewe [1970] 26 p refs
(TID-25418) Avail: NTIS

The optics of conventional electron microscopes are studied to determine if they can be applied to a scanning microscope. The scattering contrast and interference and diffraction contrast are described and it is concluded that the various types of image of the conventional microscope can be duplicated by the scanning microscope. The mechanisms peculiar to the scanning microscope, identified as the elastic and inelastic scattering and no-loss passing of electrons through very thin specimens, are discussed. Examples of micrographs and single atom contrast are given. N.E.N.

N71-10500* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDUCTIVE LIQUID LEVEL DETECTION SYSTEM Patent
Paul W. Roeske, Alex Vary, Vincent J. Grebe, and John A. Prioletti, inventors (to NASA) Issued 20 Jun. 1967 (Filed 10 Mar. 1965) 11 p Cl. 73-290
(NASA-Case-XLE-01609; US-Patent-3,326,043; US-Patent-Appl-SN-438797) Avail: US Patent Office CSCL 13G

A method and apparatus are described for determining conductive fluid levels in closed, opaque containers. The apparatus consists of axially aligned coils surrounding a tubular container. The self-inductance of each coil changes as a conductive liquid column fills the tubular spaces within the coils. The self-inductance of each coil is sequentially compared with that of a reference coil. E.C.

N71-10527# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
IMPROVED EXPONENTIAL DILUTION FLASK FOR GAS CHROMATOGRAPHY
L. J. Lorenz, R. A. Culp, and R. T. Dixon [1970] 11 p refs
(Contract AT(11-1)-1222)
(COO-1222-34) Avail: NTIS

A three-piece flask is described which was designed to reduce wear of the glass-metal bearing and alignment problems associated with the wear. The flask consists of top and bottom pieces blown from 54-mm Pyrex tubing with flanges ground and lapped on a glass plate to give a close fit. Two stirrers are provided, one of Teflon and one of glass. Studies of the flask behavior were carried out with helium flow rates of 99.0 and 10.2 ml/min. The relative standard deviation of the slope of the ln area versus time plot was found to be less than 0.001%. It is felt that the excellent fit of the ln area versus time plots indicate efficient mixing of the gases in the flask. The advantages of this flask over previous ones are absence of wear of contacting surfaces, elimination of alignment problems, and ease of dismantling and reassembling for maintenance purposes. N.E.N.

N71-10528# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF THE FEASIBILITY OF AN ELECTROGASDYNAMIC PROBE FOR MEASUREMENTS OF MEAN AND RMS VELOCITIES
Richard Alan Christianson (M.S. Thesis) Apr. 1970 57 p refs
(AD-710719) Avail: NTIS CSCL 14/2

The study involves the investigation of the feasibility of an electrogasdynamic (EGD) probe to measure mean and turbulent velocities. The free stream veolcity was 185 ft/sec and measurements were made in the wake of a circular cylinder 2 cm in diameter. Readings made with a hot-wire anemometer at the same location and in the same spectral range were used as the standard of comparison. The initial data indicated that investigations should be restricted to the region from 2 mm to 10 mm aft of the injector nozzle along the center line. Spectral data for both the hot-wire and the EGD probe measurements were obtained with a frequency analyzer and photographed from an X-Y display. The use of an EGD probe for measurements of mean and rms velocities may be feasible since the results indicate a definite correlation. The utility of the probe, however, is yet to be demonstrated since both the spatial and spectral comparisons with the hot-wire results show some lack of correspondence. The EGD unit proved to be considerably more rugged than the hot-wire probe. Author (TAB)

N71-10550# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
INVESTIGATIONS OF THE GELATIN EFFECT IN PHOTOGRAPHIC EMULSION PRECIPITATION [UNTERSUCHUNGEN UEBER DIE ROLLE DER GELATINE BEI DER FAELLUNG PHOTOGRAPHISCHER EMULSIONEN]
Dietrich Gundlach (Ph.D. Thesis) 1968 115 p refs In GERMAN
Avail: NTIS

Potentiometric determination of the silver(I) bonding properties of various gelatins at pH 7.00 to 4.65 and precipitation of Lippmann- and nuclear trace-emulsions show that gelatins take active part in the nucleation of silver halides. Emulsion precipitation proceeds by: (1) reactions of gelatin molecules with silver ions at low pAg values; (2) silver ion bonding to polar regions of gelatin

molecules in intervals of a few angstrom units; (3) spontaneous nuclei formation in polar regions of the gelatin molecule through high density of bound silver ions; (4) chemosorptive bonding of developed silver halide nuclei to the polar region of the gelatin molecules; (5) development of gelatin-silver halide conglomerates through additional enclosures of the polar regions responsible for nucleation by the growing nuclei; and (6) reaction of unoccupied polar regions of the gelatin molecule with silver ions on grain surfaces and suspension of developed gelatin-silver halide conglomerates. Transl. by G.G.

N71-10588*# Texas Univ., Dallas.
OGO-F-06 ION MASS SPECTROMETER Final Report, Mar. 1966–Jun. 1970
W. B. Hanson and J. F. Metrailer Aug. 1970 109 p
(Contract NAS5-9310)
(NASA-CR-111146) Avail: NTIS CSCL 20F

Covered is the theory of operation, design history, test history, and post launch results of the OGO-F-06 ion mass spectrometer which was mounted in OPEP I (Orbital Plane Experiment Package) of OGO-VI (Orbiting Geophysical Observatory) and launched on June 5, 1969. This experiment incurred a catastrophic failure early in the flight as a result of high voltage arcing. With this failure there were no scientific results obtained from the instrument. Author

N71-10601# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
TABLES OF FOCAL PROPERTIES OF THREE-ELEMENT ELECTROSTATIC CYLINDER LENSES
D. W. O. Heddle 15 Oct. 1970 62 p refs
(JILA-104) Avail: NTIS

Calculations of the focal lengths and other focal properties of three-element lenses consisting of coaxial cylinders of equal diameter separated by distances of 0.1 diameter are presented. All of the lens data are expressed in terms of this diameter. A cartesian sign convention is used in which distances measured to the right and upwards are positive. Author

N71-10618* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIBER OPTIC VIBRATION TRANSDUCER AND ANALYZER Patent
Alonza J. Davis, inventor (to NASA) Issued 28 Mar. 1967 (Filed 21 Oct. 1964) 14 p Cl. 73-70.2
(NASA-Case-XMF-02433; US-Patent-3,310,978; US-Patent-Appl-SN-405630) Avail: US Patent Office CSCL 14B

A vibratory instrument is described which employs fiber optical transducers coupled with a photoelectric analysis and control circuit for indicating both the frequency and amplitude of any vibration to which the instrument is subjected. The reed and stroboscopic type fiber optical transducers require only a very narrow telemetry spectrum for remote inflight tests of aerospace vehicles and onboard equipment. R.B.

N71-10662*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
INTERFEROMETER POSITION LOCATION CONCEPT. PHASE RECOVERY AND CALIBRATION, PHASE 2 Final Report
Oct. 1970 96 p refs
(Contract NAS5-21043)
(NASA-CR-111137; FSC-70-5269) Avail: NTIS CSCL 20F

Laboratory tests were performed on phase recovery and calibration techniques for a position location interferometer using low power emitters. A phase recovery technique was developed which uses a phase-locked loop and narrow-band filtering (60 Hz). Measurements made with this equipment integrated with the breadboard interferometer that was built for ATS F&C indicate a phase stability due to instrumentation of 0.2 electrical degrees (3 sigma). Space angle measurement tests were made using the 28.6 wavelength breadboard interferometer in an anechoic chamber. A 3 sigma accuracy of 0.01 mechanical degree was achieved over a 15-degree range of interferometer orientation. With a 400-wavelength interferometer, a position location error contribution of 0.2 km (1 sigma) would result from synchronous altitudes. Author

N71-10656*# GCA Technology Div., GCA Corp., Bedford, Mass.
EFFICIENCY MEASUREMENTS OF GRATINGS AT GRAZING INCIDENTS Final Report, 30 Jun. 1969–30 May 1970
James A. R. Samson Aug. 1970 8 p
(Contract NAS5-11234)
(NASA-CR-111147; GCA-TR-70-7-N) Avail: NTIS CSCL 20F

The first order efficiencies of six diffraction gratings at grazing angles of incidence of 82.5 and 88 deg for a wavelength range between 200 and 500 A were measured. The results are tabulated, and the procedures and results are discussed. It is concluded that the spectral distribution efficiencies of each grating is good. F.O.S.

N71-10667# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
AN 18.6 INCH AUXILIARY TELESCOPE SYSTEM FOR OPTICAL ACQUISITION AND TRACKING OF SPACE OBJECTS
G. Rogers Aug. 1970 25 p refs
(Contract DAHC15-68-C-0144)
(AD-711106; Rept-1386-52-T) Avail: NTIS CSCL 17/B

The report describes the on-site development, installation, and testing at Mount Haleakala Observatory of an experimental image orthicon, acquisition and tracking optical system composed of an 18.6-in. diameter, parabolic mirror combined with a 2-stage relay system. Also described is a related 10-in. diameter, single-mode telescope system which preceded the 18.6 system. Author (TAB)

N71-10714# Navy Experimental Diving Unit, Washington, D.C.
CONVERSION TABLES FOR BECKMAN CO2 ANALYZERS (MODELS IR 215 AND IR 315A) Final Report
Robert J. Biersner and Gregory Zingsheim Jun. 1970 138p refs
(AD-711320; NEDU-RR-5-70) Avail: NTIS CSCL 14/2

The report makes available to fleet diving facilities and other interested activities a set of tables for easy determination of carbon dioxide percents and partial pressures (in mmHg). These calculations are based on extrapolated functions of several different Beckman CO2 analyzers, as well as known depths (in feet of sea water). Author (TAB)

N71-10742# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DORF-1, GAMMA-RAY SPECTROGRAPH SHIELDING STUDIES
Walter R. Van Antwerp, Bernard L. Cash, William D. Hendricks, and Alvis H. Gardner Jul. 1970 43 p refs
(AD-711531; BRL-MR-2045) Avail: NTIS CSCL 18/4

A gamma-ray spectrograph, designed for use in very intense radiation fields generated by pulsed sources, has been tested in the mixed gamma-ray and neutron field of the Harry Diamond Laboratories pulsed reactor, DORF. This memorandum report presents details of the instrumentation used, results on the effectiveness of the mixed field shield-collimator design, and proof of the feasibility of gamma-ray spectrum measurements in either pulsed or steady-state reactor fields. Counting, rate-meter, and analog circuits each performed satisfactorily. However, the shield-collimator design was not satisfactory and it was necessary to make spectrum measurements with eight inches of water interposed between the spectrograph and the reactor core. Necessary changes in the shielding and collimator configurations are discussed. Author (TAB)

N71-10745# Army Engineer Topographic Labs., Fort Belvoir, Va.
INSTRUMENTATION FOR COLOR AERIAL PHOTOGRAPHY
Kenneth D. Robertson May 1970 39 p
(AD-710978; ETL-RN-70-1) Avail: NTIS CSCL 14/5

Two instruments were developed to aid in the understanding of the color aerial photographic process. The first is an instrument designed to be taken into the field to obtain information regarding the reflectance of objects and the quality of the ambient illumination. The second instrument measures the transmission versus wavelength of these objects as recorded on the aerial photograph.
Author (TAB)

N71-10762# Argonne National Lab., Ill.
CREWE ELECTRON-ENERGY-ANALYZING SCANNING MICROSCOPE
D. N. Eggenberger Dec. 1969 126 p refs
(Contract W-31-109-eng-38)
(ANL-7656) Avail: NTIS

The limitations of electron microscopes and microprobes in resolution contrast mechanisms, and analyzing ability led to the design and construction of a new instrument. Resolution improvement is obtained by a simpler optical system which focuses a point source to a point image on the speciment. A point source is approached by using cold tip emission rather than hot filament emission. Various types of contrast and some degree of specimen analysis are obtained by measuring the intensity of transmitted electrons with selected or characteristic energy loss. This makes possible high-contrast pictures among light elements without staining, as well as providing a possible means of identifying elements present in the specimen.
Author

N71-10773* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC FORCE MEASURING SYSTEM Patent
Donald R. Rummler, inventor (to NASA) Issued 2 May 1967 (Filed 26 May 1965) 8 p Cl. 177-210
(NASA-Case-XLA-02605; US-Patent-3,316,991; US-Patent-Appl-SN-459138) Avail: US Patent Office CSCL 14B

A weighing and recording device is described for obtaining precise automatic recording, for long periods of time, of small changes in force or weight without appreciable movement of the device or object being weighed. A variable differential transformer is used to sense the motion of the end of a weighing beam opposite the end where the object is placed. The output from the transformer is amplified and applied to a servomotor which changes the output current of a variable current network. The current passes through the coil of a solenoid which forces the weighing beam into its balanced position. The current through the coil is measured and recorded to give the weight.
F.O.S.

N71-10774* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GAS ANALYZER FOR BI-GASEOUS MIXTURES Patent
Leonard T. Melfi, Jr., George M. Wood, Jr., and Paul R. Yeager, inventors (to NASA) Issued 4 Apr. 1967 (Filed 8 Nov. 1963) 7 p Cl. 73-23
(NASA-Case-XLA-01131; US-Patent-3,312,101; US-Patent-Appl-SN-322545) Avail: US Patent Office CSCL 14B

A gas analyzer is described suitable for use in test facilities where rapid sampling for acquiring data is required. The difference in the relative ionization of the two gases in the bi-gaseous mixture is used for measureing the percentage composition of the gases.
F.O.S.

N71-10779* North American Aviation, Inc., Torrance, Calif.
METHOD AND APPARATUS FOR DETECTION AND LOCATION OF MICROLEAKS Patent
Norman M. Mitchell, inventor (to NASA) Issued 2 May 1967 (Filed 31 Dec. 1964) 10 p Cl. 73-40.5 Sponsored by NASA
(NASA-Case-XMF-02307; US-Patent-3,316,752; US-Patent-Appl-SN-422869) Avail: US Patent Office CSCL 14B

A leak detecting device mounted on the weld seam of the propellant tank of a rocket launch vehicle is described. The invention relates a method and apparatus for detecting fluid or gas leaks from a supposedly impervious surface. The detector is basically an electrical capacitor composed of a printed electrical conductor mounted on an impermeable dielectric secured over the weld seam. When a leak is disclosed in the weld seam from fluid or gas escaping under the tape, causing it to tear or stretch, the electrical conductor breaks.
J.A.M.

N71-10781* Mellon Inst., Pittsburgh, Pa.
INSTRUMENT FOR MEASURING TORSIONAL CREEP AND RECOVERY Patent
Donald J. Plazek, inventor (to NASA) Issued 1 Nov. 1966 (Filed 29 Oct. 1963) 7 p Cl. 73-99 Sponsored by NASA
(NASA-Case-XLE-01481; US-Patent-3,282,091; US-Patent-Appl-SN-319905) Avail: US Patent Office CSCL 14B

A material specimen whose shear-creep compliance is to be measured is placed between a solid cylinder located in a housing and a float secured by one end of a coupling rod to the housing and supported by a fluid contained in a second housing. Alignment of the float with the cylinder is provided by the specimen itself. The other end of the coupling rod has a metal disc and mirror connected to it. A torque is applied to the specimen by rotating the disk through a drive mechanism, which provides for the selective interaction of eddy currents and the magnetic field applied to the disk. The angle of twist of the specimen is indicated by the displacement of a light beam reflected by the mirror. Shear-creep compliance is determined by correlating the angle of twist with the applied torque.
R.B.

N71-10797* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METEOROID SENSING APPARATUS HAVING A COINCIDENCE NETWORK CONNECTED TO A PAIR OF CAPACITORS Patent
Elmer H. Davison, inventor (to NASA) Issued 6 Jun. 1967 (Filed 4 Jan. 1963) 3 p Cl. 324-61
(NASA-Case-XLE-01246; US-Patent-3,324,388; US-Patent-Appl-SN-249537) Avail: US Patent Office CSCL 14B

A sensor is described for making direct measurements of meteoroid damage by recording the penetration rates of particles through known metal thicknesses. The apparatus consists of a sandwich structure containing a metal sheet of known thickness that is electrically grounded. A layer of dielectric material covers each surface of the metal sheet and a film of metal is deposited on each dielectric layer to form a pair of capacitor assemblies. A coincidence counting technique is used to determine when a penetration of the sandwich occurs. As a particle passes through the sandwich, each capacitor assembly is discharged in turn and only punctures which penetrate the entire sensor are counted.
R.B.

N71-10826 Illinois Univ., Urbana.
AN ON-LINE ELECTRO-OPTICAL VIDEO PROCESSING SYSTEM
David Paul Casasent (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 70-810

An electro-optical system is described which is capable of staticizing a video image, reading it, processing it, and erasing it on-line. The image is formed as a charge pattern on an electro-optical crystal which serves as the target for an off-axis electron gun. This charge distribution, by means of the linear-longitudinal electro-optical or Pockels effect, is used to modulate a laser beam. The laser beam is pulsed on and off by a separate electro-optical modulator with variable duty cycle and output light intensity and with an extinction ratio in excess of 300:1. Either the image or its Fourier Transform can be projected

onto a pick-up tube via an optical system and displayed on a monitor. The charge pattern can then be erased by a second off-axis electron gun using secondary emission. Dissert. Abstr.

N71-10856# Naval Ship Research and Development Center, Washington, D.C. Dept. of Aerodynamics.
A STUDY OF SHORT-TIME, LOW-PRESSURE RESPONSE IN A TRANSDUCER SYSTEM
George S. Pick May 1970 35 p refs
(AD-711191; AL-74) Avail: NTIS CSCL 14/2

Existing theoretical equations were correlated with experimental pressure-time responses in the 0.1 mmHg to 3.0 mmHg pressure range in short-time response transducer systems. Experimental investigation confirmed predicted trends but the equations required modifications to account for end effects which were neglected in the original derivations. The prediction errors of these modified equations were within an acceptable range. The results provide system design criteria for free flight instrumented models in hypersonic tunnel applications. Author (TAB)

N71-10876# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
PHOTOGRAPHIC CALIBRATIONS FOR EMISSION SPECTROGRAPHY USING A SMALL COMPUTER
R. J. Heemstra Nov. 1970 14 p refs
(BM-RI-7447) Avail: Issuing Activity

A method was developed for calibrating photographic emulsions and retrieving working curves for emission spectrography. The values obtained from a digital readout or a recorder chart of a comparator-microphotometer are converted to light intensity values using an emulsion characteristic curve derived from a quartic polynomial preliminary curve. The characteristic curve, consisting of Seidel transform versus the logarithm of intensity, is split into two cubic polynomials at the zero value of the transform, resulting in eight emulsion calibration coefficients. These methods allow use of the calibration curves even at very small and very high intensities, thus extending the range of analysis. Use of a small computer allows rapid calculations. A computer program was written to formulate, code, and file each working curve along with its statistical error. Proper coding of the input data permits the direct printout of the concentration of the elements under investigation. Author

N71-10909# General Applied Science Labs., Inc., Westbury, N.Y.
LIGHT MODULATED ACCELEROMETER FOR PANTOGRAPH MEASUREMENTS Final Report, Aug. 1969 – Mar. 1970
Hector Medecki and Daniel E. Magnus Mar. 1970 31 p
(Contract DOT-FR-9-00010)
PB-193452; GASL-TR-739; FRA-RT-70-41) Avail: NTIS CSCL 13F

An instrument was developed to measure the accelerations of a pantograph shoe for power collection on railway vehicles. The basic problems of high operating voltages and severe electromagnetic interference are solved using optical methods. The intensity of a light source is modulated in proportion to the acceleration of the shoe. These signals are transmitted through fiber optics. The accelerometer was tested in field service on the DOT test cars. Author (USGRDR)

N71-10910# Thermo-Systems, Inc., Minneapolis, Minn.
DEVELOPMENT OF A PIEZOELECTRIC MICROBALANCE FOR CONTINUOUS MEASUREMENT OF AEROSOL MASS CONCENTRATION Final Report, 26 May 1969 – 27 May 1970
John G. Olin, Gilmore J. Sem, and Dale L. Christenson May 1970 39 p refs
(Contract PHS-CPA-22-69-83)
(PB-193362) Avail: NTIS CSCL 14B

This instrument detects, with high time resolution, the actual mass concentration of an aerosol cloud. The instrument uses an electrostatic precipitator to deposit aerosol particles directly onto a piezoelectric quartz crystal microbalance. The electrostatic precipitator has an advantage over impaction collection devices because it collects the total mass of most aerosols on the crystal surface. A digital readout automatically indicates actual mass concentration in units of micrograms per cubic meter. Applications of the instrument include automobile particulate emissions monitoring, industrial hygiene measurements, ambient outdoor particulate mass concentration monitoring, industrial process control and source monitoring. The complete instrument is compact, allowing hand carrying for fast, on site measurement of particle mass loadings. Author (USGRDR)

N71-10962*# Franklin Inst., Swarthmore, Pa. Bartol Research Foundation.
A PRESSURE SCANNING FABRY-PEROT MAGNETOMETER
T. D. Fay and A. A. Wyller [1970] 8 p
(Grant NGR-39-005-086)
(NASA-CR-111094) Avail: NTIS CSCL 8/14

The construction of the spectrometer to which the magnetometer is attached is described in detail. The spectrometer is designed to provide a completely self-contained, mobile, high resolution spectrometer equivalent in performance to several conventional coude spectrograph camera assemblies with a variety of spectral resolutions and wavelength coverages. The instrument is designed for full utilization of the light of solar surface features or stellar images anywhere in the range of 4000 to 12,000 A with spectral resolutions continuously variable from 1000 to 1,000,000 and dual channel pulse counting facilities. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-10021*# Mechanical Technology, Inc., Latham, N.Y.
FLEXIBLE ROTOR BALANCING BY THE EXACT POINT-SPEED INFLUENCE COEFFICIENT METHOD Final Report
Juergen M. Tessarzik [1970] 115 p refs
(Contract NAS3-13473)
(NASA-CR-72774; MTI-70TR59) Avail: NTIS CSCL 13I

A test program was conducted to confirm experimentally the validity of the exact point-speed influence coefficient method for balancing rotating machinery, and to assess the practical aspects of applying the method to flexible rotors. Testing was performed with a machine having a 41-inch long, 126-pound rotor. The rotor was operated over a speed range encompassing three rotor-bearing system critical speeds: two rigid body criticals and one flexural critical. Rotor damping at the flexural critical was very low due to the journal bearings being located at the nodal points of the shaft. The balancing method was evaluated for three different conditions of initial rotor unbalance. The method was found to be effective and practical. Safe (and slow) passage through all the critical speeds was obtained after a reasonable number of balancing runs. Success of the balancing method was, in large part, due to the accuracy of the instrumentation system used to obtain phase angle measurements during the balancing procedure. Author

N71-10033# Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF FLAME AND MECHANICAL STRAIGHTENING ON MATERIAL PROPERTIES OF WELDMENTS Summary

Report
H. E. Pattee, R. M. Evans, and R. E. Monroe Washington, D.C. Ship Struct. Comm. 1970 49 p refs
(Contract N00024-68-C-5324)
(AD-710521; SSC-207) Avail: NTIS CSCL 13/5

An experimental study was conducted to determine the effects of mechanical straightening and flame straightening on the properties of steels used in shipbuilding. The steels investigated during this program included an ordinary carbon steel (ABS-B), two low-alloy, high-strength steels (A441 and A537), and a quenched and tempered steel (A517, Grade A). The removal of distortion in unwelded and welded test plates was accomplished by (1) mechanical straightening at room temperature, 1000F, 1300F, and (2) flame straightening in the temperature ranges of 1100-1200F and 1300-1400F. Controlled amounts of distortion were provided in unwelded plate by mechanical bending; distortion in welded plates was provided by jigging the restraint control. Drop-weight tear tests were conducted to assess the effect of the straightening parameters on the notch-toughness behavior of the respective steels. Author (TAB)

N71-10075# Stanford Univ., Calif. Dept. of Materials Science.
HETEROGENEOUS NUCLEATION IN VAPOR DEPOSITION Final Report
G. M. Pound 28 Jun. 1970 5 p refs
(Grant AF-AFOSR-1283-67)
(AD-709943; AFOSR 70-1826TR) Avail: NTIS CSCL 13/8

A very brief review is given of studies in the following areas: direct electron microscopy of zinc and/or cadmium nucleation on ceramic substrates and a theoretical investigation of the Hruska equation; electron microscopy of the nucleation of gold on mica substrates; computer simulation of nucleation and growth processes on crystal surfaces; evaluation of the replacement factor and the rotational partition function for a cluster in nucleation theory; delineation of the conditions for island versus layer nucleation on field emitter tips and the effect of sensitization of the tip for nucleation by prior deposition of inorganic salts and other trace impurities. Author (TAB)

N71-10095# Royal Aircraft Establishment, Farnborough (England).
METHOD AND USE OF BATH NITRIDING: A REVIEW OF THE PRESENT STATE OF KNOWLEDGE [VERFAHREN UND ANWENDUNG DES BADNITRIERENS (TENIFER)]
Gerhard Bader Jun. 1969 34 p refs Transl. into ENGLISH from Tech. Zeitung fur Prakt. Metallbearbeit, v. 61, no. 10 and 12, 1967 p 557-563; 703-707
(RAE-LIB-Trans-1368) Avail: NTIS

The basic principles of the method are given with regard to nitriding temperature, nitriding time, depth of penetration and surface hardness for unalloyed and alloyed steels. The operation of nitriding plants, nitriding baths and pre- and after-treatment are also discussed. The changes in properties due to nitriding are explained and the possibilities of application in the manufacture of machined components and instrument technology are reviewed. Quality control in bath nitriding and the suitability of various test methods for inspecting both nitrided workpieces are presented. Author

N71-10099# General Electric Co., Philadelphia, Pa.
FRICTION AND WEAR OF SOLID MATERIALS SLIDING IN ULTRAHIGH VACUUM AND CONTROLLED, GASEOUS ENVIRONMENTS Final Report, 1 Mar. 1969 - 31 Jan. 1970
A. J. Haltner Wright-Patterson AFB, Ohio AFML Jun. 1970 48 p refs
(Contract F33615-69-C-1237)
(AD-709947; AFML-TR-70-40) Avail: NTIS CSCL 11/8

Sliding studies on additional synthetic layer lattice compounds have confirmed high friction in ultrahigh vacuum. However, the synthetic selenides studied could not be lubricated by long chain alcohols as was the case for synthetic sulfides. An analysis of the friction data for molybdenite in the presence of NH3 indicates that the step-wise rise in friction with increasing partial pressure is probably related to multilayer absorption phenomena. The changes in friction when the system is pressurized with N2 in the presence of either NH3 or O2 are probably related to the formation of mixed monolayers at the sliding interface. Wear rates of molybdenite pellets have been monitored continuously. Wear rates are highest at the lowest sliding speeds, and the wear rate increases faster than the first power of the normal loads as other variables are held constant. Author (TAB)

N71-10157# Royal Radar Establishment, Malvern (England).
RADIO FREQUENCY SPUTTERING OF DIELECTRIC FILMS
P. Lloyd *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

A practical RF sputtering system was built and is employed in device fabrication. The general arrangement is shown diagrammatically. The target, a 1/4 in. thick silica plate, is effectively one wall of a vacuum system, to the outer surface of which is applied a water-cooled copper RF electrode. The inner surface of the silica plate is exposed to the sputtering action of the ions from the RF plasma induced within the Pyrex tube. The problem of suitable vacuum lead throughs for the target has been eliminated, water cooling is readily accomplished, and coupling to the RF generator is by means of a simple low capacitance open wire feed. Matching problems are simplified as the plasma load is suitable for connection to a high impedance point on the generator output. In addition, there is the complete elimination from the chamber of target support hardware which would be a possible source of system contamination. Author

N71-10188# Defense Documentation Center, Alexandria, Va.
TECHNIQUES IN PLATING. VOLUME 1: REPORT BIBLIOGRAPHY, OCTOBER 1959 - APRIL 1969
Jul. 1970 128 p refs
(AD-709950; DDC-TAS-70-54-Vol-1) Avail: NTIS CSCL 13/8

Selected annotated references are included from the Defense Documentation Centers collection on techniques in plating and coating. The references deal primarily with types of plating, materials used for plating, and plated surfaces. The mechanical properties of deposited protective coatings are discussed. Corporate author-monitoring agency, subject, title, and AD number indexes are included. Author (TAB)

N71-10197# Defense Documentation Center, Alexandria, Va.
DIFFUSION BONDING. VOLUME 1: REPORT BIBLIOGRAPHY, NOVEMBER 1960 - SEPTEMBER 1970
Aug. 1970 80 p refs
(AD-710500; DDC-TAS-70-58-1-Vol-1) Avail: NTIS CSCL 13/8

The bibliography is a compilation of reference on Diffusion Bonding. Computer-generated indexes for Corporate Author-Monitoring Agency, Subject, Personal Author, and Contract are included. Author (TAB)

N71-10263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED PROJECTS DEVELOPMENT: ENGINEERING MECHANICS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 113-118 (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 13K

A thermochemical pump study was initiated to consider elimination or augmentation of the electric pump motor by a heat engine driven by the 200 to 300 F temperature difference between the incoming warm temperature-control fluid and the science instrument package. A Freon evaporative device was considered as the primary system for thermoelectric outer planet spacecraft. The test results indicate that such a system is feasible, but problems

that remain unsolved include the piston sealing system, the heat exchangers, and the quantitative measure of Freon masses in the heat exchanger cylinders. R.B.

N71-10281+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND SURFACE HARDNESS MEASUREMENT IN STEEL CYLINDERS DESTINED TO ALUMINUM LAMINATION [INSPECAO ULTRA-SONICA E MEDIDA DA DUREZA NA SUPERFICIE DE CILINDROS DE LAMINADORES DE ALUMINIO]
L. X. Nepomucene, M. F. Barbosa, and T. Momoi 27 Apr. 1970 10 p refs In PORTUGUESE; ENGLISH summary
(Rept-7004.425) Avail: NTIS

The equipment, specifications, and procedures are described for the ultrasonic inspection, and hardness measurement of steel cylinders used in aluminum laminates. The results are summarized in schematic drawings with the echograms observed during inspection. Author

N71-10290# Defense Documentation Center, Alexandria, Va.
INERT GAS WELDING. VOLUME 1: REPORT BIBLIOGRAPHY, DECEMBER 1960 - SEPTEMBER 1969
Jul. 1970 89 p refs
(AD-709900; DDC-TAS-70-52-1-Vol-1) Avail: NTIS CSCL 13/8

The annotated bibliography contains 64 unclassified and unlimited references. The documents cited deal with the techniques of inert gas welding as well as the characteristics of the resulting welds. Computer-generated indexes to corporate author/monitoring agency, subject, and title are provided. TAB

N71-10363# Picatinny Arsenal, Dover, N.J. Adhesives and Coatings Branch.
ACTIVATED GAS PLASMA SURFACE TREATMENT OF POLYMERS FOR ADHESIVE BONDING, PART 2
Richard J. Hall, Carolyn A. L. Westerdahl, and M. J. Bodnar Jul. 1970 33 p refs
(AD-711011; PA-TR-4001-Pt-2) Avail: NTIS CSCL 11/9

Activated gas treatment of polyethylene and nylon 6 adherend surfaces greatly improves their bondability; after such treatment, bond failure often occurs in the polymer rather than at the adhesive polymer interface. Similar treatment of many other polymers results in increased bondability. Each polymer was treated with excited oxygen and excited helium; each was treated for several different periods of time. The treatment was followed by tensile testing of lap-shear sandwich specimens bonded with an epoxy adhesive. Plots of bond strength vs treatment time showed maxima for high density polyethylene (HDPE) treated with helium, cellophane treated with both oxygen and helium, and fluorinated ethylene-propylene copolymer (FEP) treated with helium and oxygen. The plots for most polymers showed an initial rapid increase in bond strength followed by a slower increase. Bond strengths of a poly (oxymethylene) copolymer (Celcon) treated with helium reached a fairly constant value after about ten minutes. Polypropylene was treated with helium at several temperatures. Low temperature treatment gave very poor results while treatment near the softening point of polypropylene gave an eightfold increase in bond strength. Author (TAB)

N71-10488*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AN EXPERIMENTAL STUDY OF THE CRYOENTRAINMENT PUMP AND THE BEHAVIOR OF NUDE IONIZATION GAUGES AT LOW TEMPERATURE
J. A. Daggerhart 28 Sep. 1970 25 p
(Grant NGR-34-002-106)
(NASA-CR-111799) Avail: NTIS CSCL 20L

A system of cryogenic pumping whereby helium can be pumped by 77 deg K surfaces is investigated. This involves the use of the cryoentrainment principle and heavy working fluid (C4F8). Philosophy of the system is reviewed, an experimental program is described, and results are discussed. A brief discussion of work with ionization gauges and thermal transpiration effects is included. Author

N71-10557# Massachusetts Inst. of Tech., Cambridge.
DEFORMATION PROCESSING OF ANISOTROPIC METALS. (HOT BENDING OF Ti-6-Al-4V) Final Report, 1 Jul. 1969 - 30 Jun. 1970
Weldon W. Wilkening and Walter A. Backofen Aug. 1970 22 p refs
(Contract N00019-70-C-0071)
(AD-710885) Avail: NTIS CSCL 13/8

Bend formability of the titanium alloy Ti-6Al-4V was studied over the temperature range 600C (1100F) to 950C (1750F) at strain rates from about 0.001/sec to 0.1/sec. The tests were made in three-point bending with a sharp punch and matching die. Independent data on the strain-rate hardening behavior of this alloy could be used to predict performance in continuous bending. Recovery under load, after the imposed straining was stopped, was essentially complete and zero-springback bends could be made with a perfectly sharp inner radius. The super-plasticity contribution enters more in the recovery period, when falling strain rate leads to a rising rate sensitivity and a flow stress that approaches zero. A few experiments were also made on a possible technique for encasing filaments in a matrix of Ti-6Al-4V by compression-extrusion in the superplastic state. Author (TAB)

N71-10577* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THIN-WALLED PRESSURE VESSEL Patent
William C. Morgan, Jack B. Esgar, and Richard H. Kemp, inventors (to NASA) Issued 20 Jun. 1967 (Filed 13 Apr. 1965) 5 p Cl. 220-67 Continuation-in-part of US Patent Appl. SN-284760, Filed 31 May 1963
(NASA-Case-XLE-04677; US-Patent-3,326,407; US-Patent-Appl-SN-447928) Avail: US Patent Office CSCL 13D

A pressure test vessel is described in which the shell is attached to the heads by a specially configured alloy-filled joint. The low-melting alloy, upon solidification, slightly expands to bear against the sides of the joint and form a pressure tight seal. The coefficient of expansion of the low-melting alloy closely matches that of the base material of the head so that further cooling of the test vessel causes no undesirable loading. Provision is also made for matching the coefficients of expansion of the heads and shell, which provides for easy assembly and disassembly of the test vessel so that the heads may be reused. R.B.

N71-10617* Brown Engineering Co., Inc., Huntsville, Ala.
AIR BEARING Patent
John H. McLain, inventor (to NASA) Issued 13 Jun. 1967 (Filed 31 Dec. 1964) 6 p Cl. 308-5 Sponsored by NASA
(NASA-Case-XMF-01887; US-Patent-3,325,229; US-Patent-Appl-Sn-422868) Avail: US Patent Office CSCL 13I

Air bearings for supporting loads either stationary or during movement on a flat surface are described. The device comprises a main bearing component which includes a main bearing surface adapted to float on an air cushion over the supporting flat surface, thus transferring the load of the moving apparatus to the surface. The bearing surface of the main bearing is located adjacent to the bearing surface of an auxiliary bearing component, both components being movable independently of each other in a vertical plane. The air bearing permits near frictionless transfer of the load to a supporting surface and also permits deviations in the load direction. R.B.

N71-10650# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INTERMEDIATE STAGE DENSIFICATION IN VACUUM HOT PRESSING OF ALUMINA Research Report, Nov. 1968 - Jun. 1969

Ronald C. Rossi and James D. Buch 31 Jul. 1970 31 p refs
(Contract F04701-70-C-0059)
(AD-710608; TR-0059(6250-10)-1; SAMSO-TR-70-290) Avail: NTIS CSCL 13/8

An analysis was made of the densification kinetics preceding the final stage densification of alumina hot pressed in vacuum between 1150 and 1350C and between 2000 and 6000 psi. The analysis suggests a diffusional creep mechanism, possibly consistent with a Narbarro-Herring vacancy model. The measured activation energy, 116 kcal/mole, agrees with the activation energy for the final stage of densification and for the self-diffusion of aluminum ions in alumina. It is conjectured that the pore structure (i.e., open or closed) determines the stage of densification and further that pore structure has a profound effect on the apparent diffusion coefficients. Author (TAB)

N71-10658* Massachusetts Inst. of Tech., Cambridge.
HYDRAULIC DRIVE MECHANISM Patent
Kentaro Tsutsumi, inventor (to NASA) Issued 9 May 1967 (Filed 13 Jan. 1965) 6 p Cl. 60-54.5 Sponsored by NASA
(NASA-Case-XMS-03252; US-Patent-3,318,093;
US-Patent-Appl-SN-425362) Avail: US Patent Office CSCL 13G

A hydraulic drive mechanism, known as a micromotion jack, is described for leveling isolation platforms. The system is designed to prevent fluid leakage under a load capacity of 18,000 pounds. Because friction and backlash within the drive mechanism are significantly reduced, the jack is capable of receiving servomotor movements and transmitting them to the load in micro distances as small as .000001 of an inch. R.B.

N71-10670# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
INVESTIGATION OF FOIL BEARINGS WITH PARTICULAR EMPHASIS ON GAS LUBRICATED FILMS Final Report
A. Eshel 25 Aug. 1970 25 p refs
(Contract Nonr-3815(00))
(AD-711089; RR-70-13) Avail: NTIS CSCL 13/9

The report outlines foil bearing research which has been carried out. It also lists the publications which have originated from the research. Author (TAB)

N71-10672* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD FOR MOLDING COMPOUNDS Patent
Wilbur C. Heier, inventor (to NASA) Issued 2 May 1967 (Filed 11 Mar. 1964) 5 p Cl. 264-102
(NASA-Case-XLA-01091; US-Patent-3,317,641;
US-Patent-Appl-SN-351259) Avail: US Patent Office CSCL 13H

A method is described for molding low or high density ablation materials of microparticle size and high bulk factor, which results in a homogeneous stress-free part. A vacuum is drawn continuously through the thermosetting compound during the duration of cure and also through the volatile sink which allows escape of the volatiles generated within the thermosetting compound. R.B.

N71-10688# Army Weapons Command, Rock Island, Ill.
SIDE-SPREADING SPRINGS ABSORB HIGH-ENERGY IMPACT
Henry P. Swieskowski Mar. 1970 13 p
(AD-711006; RE-70-137) Avail: NTIS CSCL 13/9

Description is given on the construction and operation of a novel and efficient energy dissipating device. The shock absorber is composed of ten basic components. Frictional forces that convert kinetic energy to heat are produced by impelling springs that apply pressure between the bronze friction plungers and the housing. A design example with given requirements on absorbed energy, working stroke, and preload is illustrated in a five-step procedure. Author (TAB)

N71-10778* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PRESSURE REGULATOR VALVE Patent
William F. MacGlashan, Jr., inventor (to NASA) Issued 2 May 1967 (Filed 9 Apr. 1963) 5 p Cl. 251-61 Sponsored by NASA
(NASA-Case-XNP-00710; US-Patent-3,317,180;
US-Patent-Appl-SN-271821) Avail: US Patent Office CSCL 13K

A high pressure regulatory valve including diaphragms, a seat-engaging element, a regulatory spring using moderate force, and a knife-edge seat is described. The structural design is presented in graphic representations. J.A.M.

N71-10782* National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
QUICK ATTACH AND RELEASE FLUID COUPLING ASSEMBLY Patent
Curt P. Herold and Sam D. Stahley, inventors (to NASA) Issued 16 May 1967 (Filed 3 Apr. 1964) 10 p Cl. 285-24
(NASA-Case-XKS-01985; US-Patent-3,319,979;
US-Patent-Appl-SN-357337) Avail: US Patent Office CSCL 13E

A quick-release coupling for fueling a rocket or space vehicle with a cryogenic propellant is described. The coupling includes two sealing surfaces, one in the form of a spherical surface and the other conical in shape. The shape of the two halves provides a leakproof joint under adverse conditions of misalignment, position changes, severe vibrations, rapid flow and pressure changes, and various degrees of material contraction and icing caused by extreme temperature variations during fueling. A knife edge seal gasket is located between the two surfaces for eliminating leaks and sticking the surfaces together. A pressure operated mechanism increases the seating pressure of the seal as fluid flows through the coupling. R.B.

N71-10799* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALL-DIRECTIONAL FASTENER Patent
Weymouth B. Crumpler, inventor (to NASA) Issued 9 May 1967 (Filed 24 Mar. 1965) 5 p Cl. 287-189.36
(NASA-Case-XLA-01807; US-Patent-3,318,622;
US-Patent-Appl-SN-442558) Avail: US Patent Office CSCL 13E

A fastener is described which permits all-directional movement of a skin section or panel with respect to its supporting structure. The panel is connected to the mount on the rigid support by a bolt and nut which are permitted freedom of movement in all directions with a minimal amount of surface contact between the elements. The freedom of movement minimizes frictional forces and permits the panel to move without establishing stress concentrations. R.B.

N71-10809* International Business Machines Corp., New York. Federal Systems Div.
TOOL ATTACHMENT FOR SPREADING LOOSE ELEMENTS AWAY FROM WORK Patent
Anthony J. Charnosky, inventor (to NASA) Issued 9 May 1967 (Filed 23 Jul. 1964) 8 p Cl. 140-124 Sponsored by NASA
(NASA-Case-XMF-02107; US-Patent-3,318,343;
US-Patent-Appl-SN-384811) Avail: US Patent Office CSCL 13I

A tool attachment is described for spreading or moving away loose elements such as wires located adjacent to a terminal post. The attachment has a clamping device for securing it to the tool shaft and a lower annular sleeve with projecting fingers which is adapted to slide over the post. The fingers push away loose elements about the post as they slide down over the post, and also spread outwardly from the post after contact with the base surface to move elements further from the post. R.B.

N71-10862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF FUELS AND LUBRICATING MATERIALS
N. N. Bobrov et al 10 Jul. 1970 657 p refs Transl. into ENGLISH from Primenenie Topliv i Smazochnykh Materialov

(Moscow), 1968 p 1-488
(AD-711756; FTD-MT-24-25-70) Avail: NTIS HC $10.00/MF $0.65 CSCL 11/8

The book is a student aid for advanced petroleum educational institutions. In it are problems related to the application of fuels and lubricating materials in wheeled and tracked vehicles and in aircraft. The basic theme is the physical chemistry properties of fuels and lubricating materials, and their effect on the operation of engines, transmissions and undercarriage of machines is shown. The bases for the application of the fuel in engines with spark ignition, with ignition from compression, in jet and liquid-jet engines are given. Also, the bases for the application of oils, greases, liquid coolants and liquids for hydraulic drives, are examined. The training aid is designed for students of petroleum in higher educational institutions, mainly in nontechnological fields. It can also be used by students in other special higher educational institutions. The introduction and divisions, devoted to the physical chemistry properties of fuels, oils, greases, coolants and hydraulic liquids, were written by N. N. Bobrov. The divisions, in which the problems of the theory and design of engines and machines are examined, were written by P. I. Voropay. Author (TAB)

N71-10865# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF THE PROCESS OF ELECTROMAGNETIC STIRRING OF LIQUID METAL IN THE MOLD

M. Ya. Medzhibozhskii et al 24 Jul. 1970 18 p refs Transl. into ENGLISH from Nauchn.-Issled. Inst. Chernoi Met., Donetsk. Sb. Trudov (USSR), no. 4, 1966 p 241-251
(AD-711754; FTD-HT-23-371-70) Avail: NTIS CSCL 13/8

The effect of electromagnetic stirring (ES) on the process of the crystallization of a stationary 1250-kg ingot of 30KhGVT steel (a steel that is prone to axial porosity along the entire depth of the ingot) is investigated. Two melts of 30KhGVT steel and one melt of 30L steel were poured into molds. From each melt two ingots were cast, one with electromagnetic stirring and the other, control, without ES. It was established that inductive ES of molten metal in the mold did not - given the current intensity supplied - improve the macrostructure and density of the ingot. The tested inductive method of stirring molten metal in the mold did not - given the specified electromagnetic regimes - produce positive results; it was observed that the conductive variant tends to improve the quality of the ingot, but the conducted investigations are insufficient to warrant recommending this method. TAB

N71-10903# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DESCRIPTION AND ANALYSIS OF THE DYNAMICS OF SERVOMECHANISMS WITH THE AID OF MATHEMATICAL MODELS

E. V. Zorin et al 24 Jul. 1970 22 p refs Transl. into ENGLISH from the publ. "Tekhnicheskoy Kibernetiki. Sistemy s Peremennoy Strukturoy i Ikh Primenenive v Zadachakh Avtomatizatsii Polata" Moscow, Izd-Vo Nauka, 1968 p 251-262
(AD-711163; FTD-HT-23-407-70) Avail: NTIS CSCL 13/7

The paper examines the dynamics of a hydraulic or pneumatic servosystem (which differ only in their working fluid), of the type shown in a figure where the flexibility of the cylinder mountings and the flexibility of the power transmission from the stem to the load, respectively. It is shown that by introducing the concept of hydraulic or pneumatic springs, it is possible to obtain, in a convenient form, a unified version of the equations of motion of servosystems employing a liquid or a gas as the working fluid. The system equations linearized with respect to the equilibrium state of the working fluid, defined by a given relation. The analysis leads to an equation describing a closed-loop servosystem for zero initial conditions. This system can be written in a given form. It is shown that the linearized equations of motion in the form are valid both for a hydraulic and pneumatic servomechanism. The equations differ only in the numerical values of the constant coefficients and in the rigidities of the hydraulic and pneumatic springs. Author (TAB)

N71-10934# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NEW METHOD FOR PROCESSING RESULTS OBTAINED DURING EVALUATION OF ANTIWEAR PROPERTIES OF LUBRICATING MATERIALS ON A FOUR-BALL FRICTION MACHINE

G. I. Kichkin et al 26 Jun. 1970 10 p refs Transl. into ENGLISH from Neftepererab. Neftekhim. (Moscow), no. 8, 1969 p 17-19
(AD-711178; FTD-HT-23-316-70) Avail: NTIS CSCL 11/8

Antiwear properties were determined with 1 indicator by use of the data obtained with the 4-ball test apparatus indicating the difference between actual and ideal characteristics of the oil. In the ideal case, when the diameters of the wear mark of the balls are equal to that of the surface of elastic ball contacts, the wear curve follows a straight line on the Hertz plot of log ball mark diameter vs. log load. The ideal (antiwear) characteristics of the lubricant were determined by 2 surface areas delineated on the graph. Comparative results obtained by this method are tabulated. Author (TAB)

N71-10988# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TECHNOLOGY AND AUTOMATION OF WELDING AND SOLDERING PROCESSES, NO. 132

V. M. Yampolskii et al 1 Jul. 1970 79 p refs Transl. into ENGLISH from Tr. Mosk. Vysshee Tekhn. Uchilishcha (Moscow), no. 132, 1969 p 38-61, 73-79, 105-115, 125-134
(AD-711747; FTD-HT-23-214-70) Avail: NTIS CSCL 13/8

Contents: Certain peculiarities of the process of arc welding in a vacuum with a nonconsumable electrode; The cathode processes of a vacuum welding arc; Transfer of electrode metal and the form of the seam in vacuum welding with AMg6 alloy; Electron-beam welding of ceramics on a base of aluminum oxide with metals; Submerged arc welding of high-strength steels; and The conditions of formation of intermetallic-compound interlayers in the fusion welding of niobium with steel. TAB

N71-10974*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

CLOSED-CIRCUIT TELEVISION ARC GUIDANCE ADAPTER KIT FOR A COMPUTERIZED WELDING SKATE Final Report

K. W. Heimendinger and M. C. Krause Aug. 1970 94 p refs (Contract NAS8-24638)
(NASA-CR-102896; LMSC/HREC-D162545; HREC-4838-2) Avail: NTIS CSCL 13H

Preliminary design of the closed-circuit television guidance adapter kit was completed. The kit consists of four subsystems: (1) an illumination head; (2) viewing optics and illuminators; (3) proximity control system; and (4) wire-feed mechanism. The total kit weighs approximately 12.9 pounds of which 6.5 pounds are suspended on the torch angle manipulator. Illumination of the weld seam is provided by a split-bundle flexible light guide with 0.32 cm (1/8 in.) diameter legs (illuminators). The viewing optics utilize a single 90-degree viewing prism and lens to view the 5.08 cm (2 in.) by 8.89 cm (3-1/2 in.) viewing area. The kit utilizes a single imagescope bundle. The proximity control system utilizes a sensor capable of + or - 5 mm tolerance when located 0.25 cm from the work surface. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-10005# Harry Diamond Labs., Washington, D.C.
PARAMETRIC TUNING CHARACTERISTICS OF BARIUM SODIUM NIOBATE
Thomas J. Gleason and John S. Kruger Jun. 1970 15 p refs
(AD-710220; HDL-TM-70-16) Avail: NTIS CSCL 20/5

The observation of cw parametric fluorescence in several samples of Ba2NaNb5O15 for ten pump wavelengths between 454.5 and 528.7 nm is reported. The observed fluorescence was temperature tuned through the visible spectrum with 90-deg phase-matching. The large number of pump wavelengths used allows determination of the wavelength and temperature dependence of the parametric tuning coefficients over a region of major interest in parametric devices using Ba2NaNb5O15. Author (TAB)

N71-10017# Electrotechnical Lab., Tokyo (Japan).
RESEARCH REPORT ON LASER INFORMATION PROCESSINGS
Kenjiro Sakurai, Keisuke Kikuchi, Yoshinobu Mitsuhashi, Hiroshi Akahori, Takitaro Morikawa et al Feb. 1970 257 p refs In JAPANESE; ENGLISH summary *Its* Circ. No. 168
Avail: NTIS

Technical advancements in the field of laser information processing are described. The basic theory and mathematical foundations for optical information processing, such as analog optical computing and holography diffraction, are presented. Principles of optical analog data processing by spectrum analysis, optical filtering, and optical correlation techniques are explained. The advantages, applications, methods, problems, limitations, and development of real time data processing are reported. Author

N71-10065*# Hughes Research Labs., Malibu, Calif.
DESIGN FOR A SPACE QUALIFIED LASER, PHASE 1
W. B. Bridges Washington NASA Oct. 1970 120 p refs
(Contract NAS12-579)
(NASA-CR-1663) Avail: NTIS CSCL 20E

The research and development toward perfecting a space-qualified 5 mW He-Ne laser is reported. The laser and power supply, which are integrated into a single package, provide a rugged, lightweight, compact unit. The design details of the unit are presented. The results of special studies conducted in cold cathode geometry and lifetests, internal mirrors, mirror and window seals, and environmental testing are reported. Author

N71-10142# Royal Radar Establishment, Malvern (England).
IMAGE UP-CONVERSION FROM THE INFRA-RED TO THE VISIBLE
J. Warner *In its* RRE Newsletter and Res Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Nonlinear optics are discussed as a means of viewing infrared illuminated scenes by converting the infrared frequency to visible, and then imaging the visible radiation. This process is known as up-conversion. Techniques for increasing the photon conversion efficiency, and the phase-matched spectral bandwidth are presented F.O.S.

N71-10162# Royal Radar Establishment, Malvern (England).
A GALLIUM ARSENIDE OPTICAL RADAR
R. V. Lawrence *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p (See N71-10126 01-34)
Copyright. Avail: NTIS

Preliminary results are given for an experimental optical radar using a gallium arsenide laser. The laser operates at liquid nitrogen temperature and is pulsed with 200 A, 3 microsecond pulses at 1 to 2 kHz. E.C.

N71-10178# Naval Postgraduate School, Monterey, Calif.
HOLOGRAPHIC DETERMINATION OF TRANSLATION AND ROTATION
Richard Paul Floyd (M.S. Thesis) Jun. 1970 37 p refs
(AD-710365) Avail: NTIS CSCL 14/5

Analytic investigation was made of the light reflected by translated and rotated objects, and expressions were obtained for the interference patterns produced by this light. The technique of holography was used to experimentally measure fringe patterns produced by this interference, and to experimentally determine translation and rotation. Author (TAB)

N71-10181# Naval Postgraduate School, Monterey, Calif.
NINETY DEGREE LASER LIGHT SCATTERING FROM A LOW DENSITY PLASMA
Terrence Francis Alger (M.S. Thesis) Jun. 1970 39 p refs
(AD-709932) Avail: NTIS CSCL 20/9

The experiment was conducted to learn experimental techniques for studying Thomson Scattering at an angle of 90 degrees from a laboratory plasma. A successful method of canceling the plasma radiation was employed by using a Calcite Slab to separate the plasma radiation into two equal intensity beams which self canceled when put through a differential amplifier. Scattered light from the plasma was not observed due to the noise level of the photomultipliers and the reflections from the plasma chamber. Author (TAB)

N71-10196# Naval Postgraduate School, Monterey, Calif.
CONSTRUCTION AND SIMULATION OF A GAS DYNAMC LASER
Ronald Eugene Reedy (M.S. Thesis) Jun. 1970 54 p refs
(AD-709908) Avail: NTIS CSCL 20/5

The thesis discusses the theory behind the gas dynamic laser. A computer program that solves the equations is included along with typical outputs. A description of a test apparatus is also presented with proof of laser action. Author (TAB)

N71-10208# Royal Radar Establishment, Malvern (England).
MEASUREMENT OF WIND VELOCITY BY LASER SCATTERING
A. H. Hughes, C. J. Oliver, E. R. Pike, and J. J. B. O'Shaughnessy *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs
(See N71-10201 01-34)
Copyright. Avail: NTIS

Laser-Doppler methods are discussed for possible use in wind velocity and atmospheric turbulence measuring. Several methods were considered, all illuminating a small volume of air with a powerful laser and detecting the Doppler shift in light frequency. Calculations show that the most promising methods require coherent detection of the scattered light. A preliminary experiment was performed to measure the speed of an artificial wind containing smoke particles. J.A.M.

N71-10407# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HOLOGRAPHIC INTERFEROMETRY FOR THE STUDY OF TRANSPARENT MEDIA [INTERFEROMETRIE HOLOGRAPHIQUE POUR L'ETUDE DES MILIEUX TRANSPARENTS]
Jean Surget 1970 5 p refs In FRENCH Presented at the Intern Symp. on Appl. of Holography, Besancon, France, 6–11 Jul. 1970
(TP-851) Avail: NTIS

A quantitative study of aerodynamic phenomena by holographic interferometry is presented. A comparison of obtained results to the one proven by employment of conventional interferometry reveals perfect agreement in the dispersion boundary measurements of the same order of size for the two methods. Transl. by E.H.W.

N71-10433# Aerospace Corp., El Segundo, Calif. Lab. Operations.
POWER AND EFFICIENCY OF A CONTINUOUS HF CHEMICAL LASER

Harold Mirels and Donald J. Spencer 30 Aug. 1970 41 p refs
(Contract F04701-70-C-0059)
(AD-711067; TR-0059(6240-10)-1; SAMSO-TR-70-291) Avail: NTIS CSCL 20/5

Experimental measurements of laser power output and chemical efficiency are reported for a continuous HF chemical laser. In this device, arc-heated N2 is mixed in a plenum with SF6 to provide F atoms. The mixture is expanded to form a supersonic jet into which H2 is diffused. Population inversion and lasing are due to H2 + F to HF(v) + H, v < or = 3, Delta H = -31.7 kcal/mole. Power levels up to 1 kw have been obtained. The efficiency of conversion of chemical energy to laser power is 18% at low SF6 flow rates and approximately 10% at peak power. For a fixed arc power, addition of 02 into the plenum raises peak power by about 25% under present operating conditions and reduced sulphur deposition on mirror surfaces. The presence of HF and DF in the plenums of DF and HF lasers, respectively, did not appear to degrade laser performance. However, the presence of HF and DF in the plenums of HF and DF lasers, respectively, did degrade laser output. For given flow conditions, peak net laser power was obtained when the optical cavity axis was about 2 cm downstream of the H2 injection station. The net output power was reduced to zero when the cavity axis location was increased to 5 cm. Author (TAB)

N71-10487# Naval Research Lab., Washington, D.C.
THERMAL DEFOCUSING OF A CO2 LASER BEAM IN AIR DOPED WITH SF6 Final Report
Louis Sica and E. A. McLean 15 Jul. 1970 15 p refs
(ARPA Order 660)
(AD-710743; NRL-7107) Avail: NTIS CSCL 20/5

The transient aspects of the thermal defocusing of a CO2 laser beam (10.6 micrometers) propagating through air doped with SF6 have been studied using an infrared detector and interferometry. A comparison of these results with theory has shown that the defocusing occurring in air is qualitatively similar to that observed at 0.63 micrometers in liquid CCl4 doped with iodine. Author (TAB)

N71-10508# General Telephone and Electronics Labs. Inc., Bayside, N.Y. Research Center.
HIGH-ENERGY PULSED LIQUID LASER Semiannual Technical Summary Report, 1 Jan. – 30 Jun. 1970
H. Samelson, A. Lempicki, and R. Kocher 31 Jul. 1970 36 p ref
(Contract N00014-68-C-0110)
(AD-710813; GT/E-TR-70-826.12) Avail: NTIS CSCL 20/5

The principal results of this reporting period are the achievement of the contract objective of 50 watts average power at a repetition rate of 5 pulses per second. Even more significant is that an average power output in excess of 100 watts was achieved at the same repetition rate. The material properties of the Nd+3:POC13:ZrCl4 liquid laser system, its laser properties and the various components of the circulatory liquid laser system which led to this achievement are briefly reviewed. The behavior and properties of the repetitively pulse liquid laser are described. (The contract objective of 50 watts average power at 5 pulses per second repetition rate was readily achieved, and an average power output in excess of 100 watts with the same repetition rate is reported) and, from the output data, the laser is shown to have the low dynamic loss value of 0.35 percent/cm. Some difficulties related to the uniqueness of this laser system were experienced. The first, which involved the shaft seal on the circulatory pump, was solved by the use of a mercury dam seal. The second, which occurred with operation of the power supply at high voltages and high repetition rates, appears to be solvable. Author (TAB)

N71-10519# Owens-Illinois Technical Center, Toledo, Ohio. Consumer and Technical Products Div.
DAMAGE THRESHOLD STUDIES OF GLASS LASER MATERIALS Semiannual Technical Report, 1 Jan. – 30 Jun. 1970
Robert W. Beck 31 Jul. 1970 25 p refs
(Contract DAHC15-69-C-0303; ARPA Order 1441)
(AD-710825) Avail: NTIS CSCL 20/5

The research goal of this program is to evaluate the radiation damage thresholds of neodymium doped glass laser materials and to determine the associated damage mechanisms. Author (TAB)

N71-10558# Joint Publications Research Service, Washington, D.C.
LASER COMMUNICATIONS TODAY AND TOMORROW
R. Kazaryan et al 12 Oct. 1970 7 p ref Transl. into ENGLISH from Radio (Moscow), no. 8, 1970 p 14 – 17
(JPRS-51546) Avail: NTIS

The invention of the laser is treated as a technique for advancing communication facilities. It is proved that radio and the UHF band were enlarged to 45 gigahertz, the effective bandwidth of optical systems of communications would be 20,000 times greater than the combined spectrum of radio and UHF ranges. A helium-neon laser serving as the electromagnetic wave generator was used in an experimental automatic telephone exchange, with encouraging results. The infrared gas laser is considered promising for communication purposes, since its radiation lies in the transparency window of the atmosphere. An optical system for communication between a spacecraft and earth through the ionized shell formed around the craft during its entry into the earth's atmosphere is under development. A solar-powered laser unit was developed for communication between a spacecraft near Mars and Earth. The device used a solid state laser employing alumino-yttrium garnet, and the extent of the line is 80 million km. E.M.C.

N71-10636# Army Electronics Command, Fort Monmouth, N.J.
GAS DISCHARGE ANALYSIS OF CO2 AND HCN LASERS
Harold Jacobs and George Morris Aug. 1970 30 p refs
(AD-711523; ECOM-3321) Avail: NTIS CSCL 20/5

The electrical discharge properties of molecular lasers have not been investigated, probably due to their complexity and the difficulty of making reliable measurements in a gas discharge medium which is undergoing chemical changes. In this report, calculations have been made in which many of the kinetic properties of the ionized laser medium have been estimated. A review of some useful electrical discharge relationship is made and then the CO2, N2, He laser and the CH3CN to HCN laser are analyzed. Concepts such as electron density, molecular density, mobility, mean free paths of the electrons, average electron energy between collisions, and relaxation rates are discussed in terms of their relation to laser performance. Author (TAB)

N71-10638# Army Electronics Command, Fort Monmouth, N.J.
A STUDY OF GASEOUS REACTIONS IN PASSIVE CO2 LASER CELLS AS INDICATED BY EMISSION IN THE VISIBLE REGION
Charles J. Bickert, John N. Fulton, and James W. Mellichamp Jun. 1970 19 p refs
(AD-711522; ECOM-3286) Avail: NTIS CSCL 20/5

Passive N2-CO2-He-Xe laser cells are used to study changes in the gas composition in sealed-off systems as indicated by their spectral emission in the visible region. The spectra show the appearance and then gradual disappearance of CO bands, an increase in intensity of the first positive system of N2 in relationship to the second positive system and, finally, the complete disappearance of all band structures with only the spectral lines of Xe remaining. Data are obtained that can be of use for the extension of the lifetime of active laser tubes. Author (TAB)

N71-10640 Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPARISON OF METHODS OF LONGITUDINAL MODE SELECTION OF AN OPTICAL CAVITY

Iu. V. Troitskii [1970] 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 3, 1970 p 425–431
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The production of single-frequency lasers by quality discrimination of the optical cavity modes is discussed. The methods described are estimated according to the degree of suppression of modes adjacent to that to be extracted, minimal losses which can be introduced into the mode to be extracted, and attenuation of the type of oscillations with the least quality. The gain factor of the active medium is required to estimate the degree of discrimination of laser modes. R.B.

N71-10641 Aztec School of Languages, Inc., Maynard, Mass.
THERMAL SELF-FOCUSING OF A BEAM WITH LOWER INTENSITY NEAR THE AXIS [TEPLOVAYA SAMOFOKUSIROVKA V SVETOVOM LUCHE S UMENSHENNOY INTENSIVNOSTYU VBLIZI OSI]
G. A. Askaryan et al Lexington, Mass. Lincoln Lab. Mar. 1970 30 p refs Transl. into ENGLISH of Acad. of Sci. USSR Preprint No. 178 In ENGLISH and RUSSIAN Prepared for Lincoln Lab.
(Azt-70-197-RULL) Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

It is shown that the main part of a beam in a medium in which the ordinary beam defocuses can be made to self-focus by decreasing the intensity near the axis. Various media and different types of laser beams, including unmodulated pulse lasers and CW gas lasers, were used to investigate methods of controlling the self-focusing process. The nonlinear optical effects can be controlled by varying the profile of the beam intensity distribution. Author

N71-10643 Lockheed Missiles and Space Co., Palo Alto, Calif.
SCIENCE ADVANCES HORIZONS: LASER-METEOROLOGIST
V. Zuev [1970] 4 p Transl. into ENGLISH from Pravda (Moscow), no. 293(19071), 20 Oct. 1970 p 3
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The use of lasers for probing the atmosphere for gathering information for weather forecasting is discussed. Laser sounding permits continuous and accurate evaluation of any meteorological parameter along the ray path. The possibilities of orbital stations equipped with laser locaters for disclosing aerosol layers and clouds invisible to the eye are also discussed. It is concluded that the cooperation of scientists of different specialties will make the laser a reliable tool of the weather forecaster. F.O.S.

N71-10726*# Houston Univ., Tex.
THE EFFECT OF GRAVITATIONAL FIELDS ON THE POLARIZATION OF ELECTROMAGNETIC SIGNALS Final Technical Report, 1 Sep. 1969 – 31 Aug. 1970
R. M. Kiehn 31 Aug. 1970 32 p refs
(Grant NGR-44-005-085)
(NASA-CR-111142) Avail: NTIS CSCL 20E

The construction of a propagation-direction degenerate, ring laser system is described. The research was aimed at providing proof that four states of optical resonance can simultaneously exist within an optical cavity, and to develop an apparatus with sufficient stability and sensitivity to measure the beat frequencies between these coexisting states when the degeneracy between them is lifted by means of some acceleration gravitational field. Preliminary experimental work appears to have verified the possibility of simultaneously exciting all four modes of propagation within a single re-entrant (ring) optical cavity. The quadrature signals were not detected in a quantitative manner, but their qualitative existence was established. D.L.G.

N71-10830# Stanford Univ., Calif. Microwave Lab.
A FRESNEL DRAG LASER GYROSCOPE
G. A. Massey Nov. 1969 185 p refs
(Contract F33615-67-C-1245)
(AD-711654; SU-ML-1812) Avail: NTIS CSCL 17/7

The work is an evaluation of a technique for determining, with high sensitivity, the orientation of the spin axis of a transparent, unmarked spherical rotor. The method makes use of the Fresnel drag effect, whereby the rotation of the dielectric sphere produces a non-reciprocal phase shift on light refracted through the rotor. By placing the rotating sphere inside the cavity of a traveling-wave ring laser, this phase shift can be measured by detecting the frequency difference or beat between the laser oscillations traveling in opposite directions. In this study we have analyzed the basic operation of the device and have derived a figure of merit by which the most suitable laser transition for this application can be chosen. An optical resonator using a non-spherical concave mirror to compensate for astigmatism introduced by the off-center refraction of the laser modes through the sphere has been designed and operated. The various sources of error in measuring the cosine of the axis angle with this technique have been investigated in detail; these error sources include dispersion of the rotor and laser media, Langmuir flow of gas in the laser tube, and mode coupling by backscattering. The effect of departures from roundness and displacements of the rotor from its ideal position have been considered also. TAB

N71-10847# Naval Academy, Annapolis, Md.
GENERATION OF SECOND HARMONIC LIGHT IN TRANSPARENT MEDIA
James Richard Laricks 15 May 1970 58 p refs
(AD-711283; USNA-TSPR-4) Avail: NTIS CSCL 20/5

The purpose of this study and experimentation to produce a more efficient generator of optical harmonics. Generation of second harmonic light was studied using a pulsed ruby laser and various transparent materials. The electric field of the beam serves as a driving function and the binding potential of the electrons serves as a restoring agent. As the electric field passes through the transparent media, the electrons are displaced from normal positions. The binding potential resists this motion and the electrons take up oscillations that reflect the existence of both forces. The mathematics predicts a result involving optical harmonics which was verified in this project. Detectable amounts of second harmonic light generated in this manner require utmost attention to experimental details. Many conditions must be met in order to produce the effects of harmonic generation of light. A differential equation may be written to describe this oscillation of electrons using characteristics of the laser beam and the bombarded materials. Author (TAB)

N71-10976# Joint Publications Research Service, Washington, D.C.
SODIUM LINE LASER WITH Na(+) AND H(−) RECOMBINATION
A. M. Shukhtin et al 15 Oct. 1970 25 p refs Transl. into ENGLISH from the publ. 'Fizika Gazovykh Lazerov' Leningrad, 1969 p 122–144
(JPRS-51577) Avail: NTIS

Considered is the construction of a sodium line laser through recombination coefficients of positive Na and negative H ions. It is shown that the ion-ion recombination is of a sharply selective nature with respect to sodium levels and that almost the entire recombination flux goes to the 4s level population where it dominates the contribution of impact-radiative recombinations. Contribution of the ion-ion recombination to the volumetric losses of positive Na ions depends on the number of negative H ions present in the laser discharge. The amplification coefficient for the investigated transition 4S1/2-3P3/2 is determined by generation wavelength, halfwidth of the contour, and the probability of radiative transition. It is concluded that resonance in the level population

as a result of ion-ion recombination reaction is worse for potassium than for sodium, and is practically absent for cesium and rubidium. G.G.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-10008*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLE OF HYDROGEN IN HOT-SALT STRESS-CORROSION OF A TITANIUM ALLOY
Hugh R. Gray [1970] 38 p refs Proposed for presentation at Intern. Symp. on Stress Corrosion Mech. in Titanium Alloys, Atlanta, 27-29 Jan. 1971; sponsored by the Natl. Assoc. of Corrosion Engr.
(NASA-TM-X-52899) Avail: NTIS CSCL 11F

The role of hydrogen was studied in promoting embrittlement at elevated temperatures, where the process of hot-salt stress-corrosion occurs. Salt-coated specimens of the Ti-8Al-1Mo-1V alloy were subjected to low-strain-rate tensile tests, creep exposure tests, and stress-rupture tests to demonstrate the effects of hot-salt stress-corrosion. Severe embrittlement and/or cracking was observed in all types of tests. Significant increases in hydrogen concentrations in stress-corroded specimens were measured by standard vacuum-fusion chemical techniques. Ion-probe mass-spectrometric techniques revealed that hydrogen was segregated near the fracture surface to extremely high concentrations (several thousand ppm). These high concentrations were duplicated by thermal hydrogenation of the as-received Ti-8Al-1Mo-1V alloy specimens. These were brittle when tensile tested at 800 F (427 C). Salt-coated specimens were similarly embrittled when tested under identical tensile conditions. Author

N71-10027*# IIT Research Inst., Chicago, Ill. Metals Research Div.
THERMAL FATIGUE DATA ON 15 NICKEL- AND COBALT-BASE ALLOYS
Maurice A. H. Howes 15 May 1970 150 p refs
(Contract NAS3-9411)
(NASA-CR-72738; IITRI-B6078-38) Avail: NTIS CSCL 11F

The fluidized bed technique was used to measure the relative thermal-fatigue resistance of 15 superalloys B1900, IN-100, PWA 1401, X-40, WI-52, MAR-M 200, PWA 664, MAR-M 302, IN-162, IN-713C, M22, TAZ-8A, Udimet 700 (cast and wrought), and TD-NiCr. PWA 1401 and PWA 664 were directionally solidified. B1900, IN-100, and PWA 1401 were also tested with aluminum-10% silicon coatings. Among the 15 alloys, cycles to cracking differed by several orders of magnitude. Coatings and directional solidification were of definite benefit. Some alloys experienced serious weight losses and internal oxidation. Author

N71-10047*# General Electric Co., Evendale, Ohio.
DEVELOPMENT OF HIGH-TEMPERATURE CHROMIUM ALLOYS Final Report
J. W. Clark 4 Nov. 1970 150 p refs
(Contract NAS3-7260)
(NASA-CR-72731) Avail: NTIS CSCL 11F

Mechanical properties and air-oxidation behavior of 400 chromium-base compositions were determined at temperatures up to 2400 F. The studies show that tungsten is superior to molybdenum and rhenium as a strengthening element, but it has an adverse effect on workability and low-temperature ductility. Carbides and borides strengthen without adversely affecting ductility. The air-oxidation resistance of Cr-Y alloys containing dispersions based on Cb, Ta, or Ti is markedly inferior to those with Hf-rich or Zr-rich secondary phases. Additions of La or of La plus Y are shown to be more effective than Y alone. Author

N71-10053# City Coll. of the City of New York. Dept. of Physics.
KONDO EFFECT IN DILUTE ALLOYS Final Report
Myriam P. Sarachik 27 Jul. 1970 8 p refs
(Grant AF-AFOSR-894-67)
(AD-710297; AFOSR-70-1960TR) Avail: NTIS CSCL 20/3

An investigation of Pd containing Mn or Gd showed that some of Kondos predictions did not hold for these systems. (B) Measurements were made of the magnetostriction and the pressure dependence of the Curie temperature in dilute Pd-Fe alloys. (C) A systematic investigation of Ru, Ru-Rh, Rh and Rh-Pd alloys containing Fe showed that anomalous resistivity occurred throughout this system, and that the Knapp two-band model could not correctly account for the measured properties. (D) A series of careful experiments on Os-Ir, Ir and Ir-Pt alloys over an extended temperature range produced results which have led Kaiser and Doniach to formulate a theory for scattering of conduction electrons from localized spin fluctuations. (E) Measurements for Co dissolved in Mo-Nb alloys showed that the Kondo temperature did not vary exponentially as expected on simple theoretical grounds. (F) Resistance minima and negative magnetoresistances at low temperatures were observed in Ni-Cu alloys, and are probably caused by spin-flip scattering of conduction electrons from the giant polarization clouds which are known to exist in these systems. (G) Theoretical predictions of anomalous behavior of the Hall coefficient in Kondo systems have been confirmed (for the first time) in the Cu-Au-Fe system, thus providing important additional evidence for the existence of the low temperature quasi-bound state. Author (TAB)

N71-10063# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF NONDESTRUCTIVE TESTING TECHNIQUES FOR DETECTING STRESS IN BRITTLE MATERIALS, PHASE 2 Quarterly Technical Progress Reports
27 May 1970 22 p
(Contract N00156-69-C-0856; ARPA Order 1247)
(AD-710008; QTPR-1; QTPR-2; QTPR-3) Avail: NTIS CSCL 13/8

Efforts undertaken toward the development of magneto-optic and induction-coil Barkhausen non-destructive test methods are described. TAB

N71-10166# Naval Research Lab., Washington, D.C. Physics Metallurgy Branch.
ARPA COUPLING PROGRAM ON STRESS-CORROSION CRACKING Final Quarterly Report
G. Sandoz, ed. May 1970 46 p refs
(ARPA Order 878)
(AD-709903; NRL-MR-2141; QR-14) Avail: NTIS CSCL 11/6

The report contains a compilation of abstracts from journal articles, recent reports, and talks generated under the ARPA Coupling Program on Stress Corrosion Cracking, ARPA Order 878. The abstracts are from work done at The Boeing Company, Carnegie-Mellon University, Lehigh University, and the Naval Research Laboratory. Selected abstracts of articles from outside the ARPA Program in the field of stress-corrosion cracking are also included as well as a Diary of Events section. Author (TAB)

N71-10193# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF NONDESTRUCTIVE TESTING TECHNIQUES FOR DETECTING STRESS IN FERROMAGNETIC MATERIALS, PHASE 1 Final Report
C. G. Gardner, J. R. Barton, and D. L. Davidson 15 Sep. 1969 34 p

(Contract N00156-69-C-0856; ARPA Order 1247)
(AD-710012) Avail: NTIS CSCL 13/8

The program had as its major over-all objective the provision of a sound engineering basis for exploiting the dependence of magneto-absorption and the Barkhausen effect upon stress as a means of practical stress measurement. TAB

N71-10198# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
THERMODYNAMICS OF VANADIUM ALLOYS. PART 1: MASS SPECTROMETRIC DETERMINATION OF THERMODYNAMIC PROPERTIES OF VANADIUM-TITANIUM ALLOYS Final Report, Jan. 1969 - Apr. 1970
Edmund J. Rolinski (AFSC, Wright-Patterson AFB, Ohio), Michael Hoch, and Charles J. Oblinger Wright-Patterson AFB, Ohio AFSC Jun. 1970 53 p refs
(Contract F33615-67-C-1565)
(AD-709957; AFML-TR-70-119-Pt-1) Avail: NTIS CSCL 11/6

The Knudsen effusion method was combined with a mass spectrometer sensing technique in order to measure thermodynamic quantities of solid solution alloys of V-Ti in the b.c.c. (beta) phase. The technique makes use of the regular solution model in order to treat the vaporization data in terms of ion current ratios obtained from the mass spectrometer. The internal consistency between the data was demonstrated by calculating the relative electron impact ionization cross sections and found to agree with previously reported calculated results. The pairwise interaction parameter for the V-Ti binary alloys was found to be 1.82 plus or minus 0.13 Kcal/g-atom for the experimental temperature range of 1500 to 1725C and for .10 < N sub Ti <.90 atomic percent. The experimental result on the pairwise interaction parameter agrees with the theoretically calculated value. Author (TAB)

N71-10250# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
EFFECT OF HEAT TREATMENT ON THE DISCONTINUOUS YIELDING OF Al-Cu ALLOYS
Avraham Rosen May 1970 47 p refs
(Contract F61052-69-C-0042)
(AD-710317; MED-26; AFOSR-70-2092TR; SR-5) Avail: NTIS CSCL 11/6

The repeated discontinuous yielding of three high-purity aluminum-copper alloys after different annealing treatments was investigated. The study included tensile testing at various strain rates, stress-relaxation experiments, optical and electron microscopy, and microprobe analysis. It was found that whereas the annealing temperature has almost no effect on the structure and tensile properties of the 1% Cu alloy, in the 3% Cu and 4.5% Cu alloys the effect is very marked. The strain-aging-induced negative slope in the flow-stress strain-rate relation, and therefore also discontinuous yielding behavior, are influenced by the heat treatment through the latters governing the structure of the alloys. Author (TAB)

N71-10288# Aerojet-General Corp., Sacramento, Calif. Materials Research Lab.
PHASE EQUILIBRIA INVESTIGATIONS OF BINARY, TERNARY, AND HIGHER ORDER SYSTEMS. PART 3: PHASE EQUILIBRIA STUDIES IN THE Nb-Ta-C SYSTEM
Phillip H. Booker and Erwin Rudy Wright-Patterson AFB, Ohio AESC May 1970 69 p refs
(Contract F33615-67-C-1513)
(AD-709946; AFML-TR-69-117-Pt-3) Avail: NTIS CSCL 11/6

The solid state and solid-liquid equilibria of the Nb-Ta-C system was determined by melting point determinations, X-ray and chemical analysis, metallography, and differential thermal analysis for temperatures above 1500C. The ternary system has a complete solid solution of monocarbides and also of subcarbides if the differences in carbon atom ordering is disregarded. Eutectic troughs in both the metal-rich and carbon-rich regions of the ternary are present. Calculated tie-line distributions agree well with experimental results. Author (TAB)

N71-10326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A COBALT-BASE ALLOY, HS-31, MADE BY EXTRUSION OF PREALLOYED POWDERS
John C. Freche, Richard L. Ashbrook, and William J. Waters Washington Nov. 1970 26 p refs
(NASA-TN-D-6072; E-5770) Avail: NTIS CSCL 11F

Bars extruded from prealloyed powders of HS-31 made by argon gas atomization were evaluated by tensile and stress-rupture tests in the as-extruded and heat treated conditions. Significant improvements in tensile strength over the as-cast condition were obtained with the as-extruded powder product up to 1400 F, but lower strengths were observed in the 1500 deg to 1800 F temperature range. Heat treatments involving temperatures above the solidus and 30,000-psi pressure substantially increased the stress-rupture life of the extruded powder product over that of cast HS-31 at intermediate temperature (1200 F) and resulted in comparable life at high temperature (1800 F). Author

N71-10330# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A REVIEW OF Ti-6Al-6V-2Sn FATIGUE BEHAVIOR Research Report, 15 Jan. - 1 May 1970
Maurice F. Amateau and E. George Kendall 15 Jul. 1970 115 p refs
(Contract F04701-70-C-0059)
(AD-710635; TR-0059(6250-10)-6; SAMSO-TR-70-275) Avail: NTIS CSCL 11/6

A compilation of Ti-6Al-6V-2Sn fatigue data is presented for a number of different material forms and conditions. Stress versus log cycles to failure (S-N) curves or master diagrams, or both, for annealed, solution-treated and aged, and thermomechanically worked materials are included. The data are organized according to material form, such as sheet, plate, rolled bar, forging, and extrusion. Crack propagation behavior in air and salt water is also included. The general characteristics of Ti-6Al-6V-2Sn fatigue are discussed and compared with those for other titanium alloys. Author (TAB)

N71-10352*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS. 2: LONG-TIME TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS
G. G. Lessmann and R. E. Gold Washington NASA Sep. 1970 171 p refs
(Contract NAS3-2540)
(NASA-CR-1608; WANL-PR-(P)-014) Avail: NTIS CSCL 11F

The thermal stability of refractory metal alloys which showed promise for application in high temperature space power systems was determined. Electron beam and gas tungsten arc welds were evaluated as well as base metal. Only the very fabricable columbium and tantalum base alloys were evaluated. The alloys included T-111, T-222, Ta-10W, FS-85, D-43, B-66, C-129Y, Cb-752, and SCb-291. These represent all of the commercial alloys prominent at the inception of the aging studies. The fabricable alloys were screened for high temperature stability over long exposure times. Bfd testing for ductility changes as reflected in the bend transition temperature was emphasized as a screening technique. Tensile testing, hardness-determinations, and extensive optical and electron metallography were also employed. Fracture modes of the alloys were also studied. Some aging effects were noted in all of the alloys studied. None of these effects would be detrimental in normal application of these materials. These effects ranged from simple grain growth in the case of Ta-10W and SCb-291 to classic overaging response in the D-43 alloy. For Vol. 1 see N70-36774, for Vol. 3 see N70-40735, for Vol. 5, see N71-10353. Author

N71-10353*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS. 5: WELDABILITY OF TUNGSTEN BASE ALLOYS
G. G. Lessmann and R. E. Gold Washington NASA Sep. 1970 110 p refs
(Contract NAS3-2540)
(NASA-CR-1611; WANL-PR-(P)-017) Avail: NTIS

The weldability of unalloyed tungsten and two tungsten alloys was evaluated. The alloys were evaluated as arc cast material and for the ternary alloy also as a powder metallurgy product. The most important aspect of welding unalloyed tungsten was that it is very sensitive to thermal chock. High preheat temperatures (to 1400 F) alleviated this problem. The W-25Re alloy had improved thermal shock resistance but was shown to be basically hot tear sensitive in gas tungsten arc welding. Preheat temperatures of 1400 F were again beneficial. The powder metallurgy W-25Re-30Mo alloy displayed excellent weldability whereas the arc cast material displayed extensive hot tearing and poor weldability. The anomalous hot tearing behavior of the arc cast W-25Re-30Mo alloy was ascribed to a very high sensitivity to oxygen contamination. The effects of post weld annealing, joint preparation, and aging for 1000 hours at temperatures to 3000 F were evaluated. The high temperature tensile strength of base metal, gas tungsten arc welds and electron beam welds in W-25Re-30 Mo was determined. For vol. 1 see N70-36774; for Vol. 2 see N71-10352; and for Vol. 3 see N70-40735. Author

N71-10447*# Martin Marietta Corp., Denver, Colo.
CRYOGENIC ALLOY SCREENING Final Report
F. R. Schwartzberg, R. D. Keys, and T. F. Kiefer Nov. 1970 150 p refs
(Contract NAS3-11203)
(NASA-CR-72733) Avail: NTIS CSCL 11F

Three materials, 2021-T81 and X7007-T6 aluminum alloys, and cryogenically stretched 301 stainless steel, were evaluated in order to determine their mechanical properties, static fracture toughness, cyclic flaw-growth behavior, and sustained load threshold stress intensity. Testing was performed for both parent metal and welded material at 70, -320, and -423 F. Surface flaw and compact tension specimens were used for the fracture mechanics portion of the evaluation. The results showed that the two aluminum alloys were quite tough. The 2021-T61 alloy is not greatly superior to 2014-T6 from a strength standpoint, but may be desirable from a weldability standpoint. X7007-T6 exhibits excellent static and cyclic strength properties but appears to have a low sustained load crack growth threshold. The cryogenically stretched stainless steel exhibits an excellent combination of properties. Author

N71-10454*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL CYCLING ON A 3-INCH-DIAMETER COLUMBIUM-1 PERCENT ZIRCONIUM TO 316 STAINLESS STEEL TRANSITION JOINT
Harry M. Cameron Washington Nov. 1970 11 p ref
(NASA-TM-X-2118; E-5798) Avail: NTIS CSCL 11F

The effect of thermal cycling on the integrity of a Cb-1Zr to stainless steel 3-inch (8-cm) diameter tubular coextruded joint was investigated. The joint was cycled 78 times between 300 and 1550 F (149 to 843 C) and 500 times between 1450 and 1600 F (788 to 871 C). Extensive post-test examination revealed no metallurgical changes or deterioration of the bond between the two metals. Some diametral contraction was measured in the transition area. Author

N71-10483# National Materials Advisory Board, Washington, D.C.
PROCEEDINGS OF THE BERYLLIUM CONFERENCE, VOLUME 1
Jul. 1970 665 p refs Conf. held at Arlington, Va., 23–25 Mar. 1970
(Contract DA-49-083-OSA-3131)
(AD-710704; NMAB-272-Vol-1) Avail: NTIS CSCL 11/6

The conference was staged to put before designers of military hardware a wide variety of applications of beryllium, in order to insure that design situations in which the metal might be used profitably would not be overlooked or unjustifiable passed over. The sense of the presentations and of the resulting discussions is summarized in the first brief paper entitled Overview. The hardware display and the case histories presented at the conference showed that beryllium has come of age as an engineering material. When the materials selection process ranks beryllium as a best choice, the property data, design, fabrication, and inspection techniques are available to enable the production of reliable hardware. Author (TAB)

N71-10509# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF COMPACTION DURING PACKING OF TITANIUM POWDER
V. K. Sorokin 17 Jul. 1970 9 p refs Transl. into ENGLISH from the publ. "Materialy Vsesoyuznoy Konferentsii po Poroshkovoy Metallurgii, 9th, 1968" RIGA 1968 p 110–113
(AD-711145; FTD-HT-23-389-70) Avail: NTIS CSCL 13/8

The compaction process during the packing of titanium powder is investigated. It is shown that the compaction intensity of the powder with an increase in packing pressure is characterized by the packing coefficient and by the degree of compaction. The possibility of using the packing equations for calculating compaction processes of titanium powder is examined. Author (TAB)

N71-10561# Case Western Reserve Univ., Cleveland, Ohio. Div. of Metallurgy and Materials Science.
THE INFLUENCE OF STRUCTURAL PARAMETERS ON THE YIELD STRENGTH OF TEMPERED MARTENSITE AND LOWER BAINITE
D. W. Smith and R. F. Hehemann Jul. 1970 33 p refs
(Contract N00014-67-A-0404-0001)
(AD-710789; TR-1) Avail: NTIS CSCL 11/6

The contributions to the yield strength of tempered martensitic and bainitic structures was examined in 4340 steel. The principal factors that contribute to the reduction in yield strength with tempering in the range from 600 to 1000F are carbide coarsening and enlargement of the cellular substructure. The yield strength of both tempered martensitic and bainitic structures can be described in terms of cell size and dispersoid distribution by a single relationship in which the Orowan model is employed for the contribution from dispersion hardening and the Langford-Cohen model for that from cell size. Author (TAB)

N71-10628# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.
ELLIPSOMETRIC STUDY OF THE OXIDATION OF MILD STEEL IN AQUEOUS SOLUTIONS Interim Report, 1 Jul. 1968–30 Aug. 1969
Bernard J. Bornong Mar. 1970 28 p refs
(AD-711008; AMSWE-RE-TR-70-129) Avail: NTIS CSCL 11/6

Combined ellipsometric and potentiostatic measurements were made on the oxidation of mild steel in pH 7.4 borate-boric acid buffer solutions. The ellipsometric results are described in this report. The potentiostatic data are presented in a report on another work unit. Anodic film thicknesses on the steel surface ranged from 19 to 88A in the anodic overpotential range of 0.7 to 1.7 volts. Film thicknesses increased rapidly near the potential for pitting. Chloride ions in the solution narrowed the potential range for stability of the anodic film, but did not change its thickness appreciably. Films formed by aging the steel in the buffer solution with no potential applied, developed to average thicknesses of 58-60A in

three hours. Adsorbed films of barium dinonylnaphthalene sulfonate desorbed rapidly from the steel surface under anodic polarization, but were stable in an overpotential range of 0.1 to 0.2 volt cathodic. Desorption of the sulfonate film, as observed ellipsometrically, occurred at an electrode potential of approximately -400 millivolts vs. the standard calomel electrode. The behavior of the octadecylamine adsorbed films was similar to that of the sulfonate. Stearic acid under some conditions reacts with the steel or its oxide-coated surface. Author (TAB)

N71-10630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF COMPOSITION AND HEAT TREATMENT ON THE WEAR RESISTANCE AND FATIGUE STRENGTH OF A MEDIUM CARBON-STEEL

I. G. Uzlov et al 26 Jun. 1970 8 p Transl. into ENGLISH from Sb. Tr., Inst. Chernoi Met. (Moscow), no. 30, 1969 p 120-122
(AD-711157; FTD-HT-23-345-70) Avail: NTIS CSCL 11/6

Ways of raising the wear resistance and fatigue strength of a material by changes in chemical composition, hardness, and structural condition were shown for a steel containing C 0.51-0.62, Mn 0.71-0.81, Si 0.27-0.28, P 0.031-0.036, S 0.027-0.036, Cr 0.12-0.15, Ni 0.10-0.12, and Cu 0.12-0.15 percent. A thermally strengthened medium-C steel with lamellar carbide structure has a high resistance to wear over a wide range of hardness values. Raising the C content and increasing the hardness by heat treatment are important factors in raising its fatigue strength. Author (TAB)

N71-10633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESEARCH ON THE ABRASIVE WEAR RESISTANCE OF MANGANESE CAST IRON INOCULATED WITH CERIUM, USING THE Kh4-B MACHINE

M. Masumov 2 Jun. 1970 9 p refs Transl. into ENGLISH from Tr. Tadzhiksk. Selskokhoz. Inst. (Stalinabad), v. 13, 1968 p 85-87
(AD-711156; FTD-HT-23-249-70) Avail: NTIS CSCL 11/6

The abrasive-wear resistance of austenitic Mn cast irons MCh4Ts, MCh6Ts, MCh10Ts, and MCh12Ts containing different Mn contents, i.e. 4.0-11.0 percent, and modified with 0.012-0.110 percent Ce was studied. The highest wear resistance was shown by MCh4Ts (containing Mn 4.0 percent). TAB

N71-10738# Cambridge Univ. (England). Cavendish Lab.

THE FRICTION AND WEAR OF SOLIDS AT VERY LOW TEMPERATURES Final Report, 1 Apr. 1965-1 Apr. 1968

F. P. Bowden and T. H. C. Childs Wright-Patterson AFB, Ohio AFML Jul. 1970 46 p refs
(Contract AF 61(052)-870)
(AD-711668; AFML-TR-68-343) Avail: NTIS CSCL 11/6

Sliding friction and wear studies have been carried out on gold, silver, copper and nickel, tantalum, iron, molybdenum and tungsten, cobalt, beryllium, zirconium and titanium in ultra high vacuum, at temperatures between 20K and 300K. Changes in friction with temperature have been small, but those which have occurred have been accompanied by a change of surface deformation. With face centered cubic metals, which remain ductile to the lowest temperatures, a transition from a continuously grooved track to a torn track, accompanied by a drop in the coefficient of friction, occurred when the initial work hardening rate exceeded 135 kg/sq mm per unit strain. With the body centered cubic metals drops in friction at low temperatures could be correlated with their brittle ductile transition properties. The hexagonal metals showed no change in friction with temperature, but as a group, showed an increasing amount of friction and wear the more ductile they were. Author (TAB)

N71-10760# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

KINETIC STUDY OF NIOBIUM OXYCHLORIDE CHLORINATION IN A FLOW REACTOR BY SEQUENTIAL STATISTICAL DESIGN

Robert Jost Graham (Ph.D. Thesis) May 1970 115 p refs
(Contract W-7405-eng-82)
(IS-T-376) Avail: NTIS

The kinetics of the gas phase chlorination of $NbOCl_3$ with $COCl_2$ was studied using a constant temperature flow reactor. Several rate equation models were considered. The best estimates of the parameters, determined by nonlinear least squares analysis, were A = 1.461 × 10 to the 6th power, E = 23316 cal/g mole, Theta sub 3 = 0.829 and Theta sub 4 0.921. The units of A are consistent with dC sub A/dt expressed in g moles/liter, sec. The experimental data was obtained at low $NbOCl_3$ concentrations (less than 20 mole %) at essentially ambient pressure for the temperature range 340-450 C. The effect of the size of an independent normal error with variance, sigma sub e squared, on the accuracy and convergence of the parameter estimates was considered. A sequence of pseudo-experiments was constructed for each of three values of (sigma sub e = 0.0005, 0.002, 0.003) using the Delta criterion to choose the conditions for the pseudo-experiments. The size of sigma sub e greatly affected both the accuracy and the convergence of the parameter estimates. The upper limit of sigma sub e for accurate estimates and rapid convergence was estimated to be in the range 0.001 to 0.002 for the conditions of this work where y values varied between 0.005 and 0.085. Author

N71-10824# Scientific Translation Service, Ann Arbor, Mich.

ANALYSIS OF THE INFLUENCE OF THE DOWN-STREAM EFFECT ON THE RESULTS OF SODIUM CORROSION TESTS AND THEIR USEFULNESS FOR REACTOR DESIGN [UBERLEGUNGEN ZUM EINFLUSS DES DOWNSTREAM-EFFEKTS AUF DIE ERGEBNISSE VON NATRIUM KORROSIONSVERSUCHEN UND DEREN NUTZBARKEIT FUR DIE REAKTORAUSLEGUNG]

H. J. Borgstedt et al Jun. 1970 13 p refs Transl. into ENGLISH from German report KFK-1061 Sponsored in part by AEC Prepared for Argonne Natl. Lab
(ANL-Trans-839; KFK-1061) Avail: NTIS

The downstream effect in liquid sodium corrosion of stainless steels is normally described as an effect of the saturation of liquid sodium with corrosion products. Using the results of corrosion tests the increase in concentration of iron in sodium passing the hot parts of the systems was calculated. The results are compared with the saturation concentrations of iron in liquid sodium. There is no significant raise of the iron concentration in the high temperature sections of the loops. Therefore, the downstream effect cannot be due to the sodium saturation. The test results are free from any saturation influence and from systematic errors due to such an effect. Therefore, the measured corrosion rates can be used for reactor calculation. The downstream effect may be caused by inconstant conditions in the test sections of the corrosion loops. Author (NSA)

N71-10825# Joint Publications Research Service, Washington, D.C.

HEAT-RESISTANT STEELS

K. A. Lanskaya 28 Oct. 1970 92 p refs Transl. into ENGLISH from Zharoprochnyye Stali (Moscow), 1969 p 159-240
(JPRS-51658) Avail: NTIS

Heat resistant steels are evaluated for their application in steam heaters and steam line pipes of powerful boiler units. Considered are chemical compositions, microstructures, and mechanical properties as functions of heat treatment during fabrication of low-alloy chromium-molybdenum-vanadium steels and high-alloy steels of the ferritic and austenitic classes. A summary graph for the stress-rupture strength as a function of temperature of the various investigated steels is included. G.G.

N71-10854 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MODERN METHODS OF OBTAINING TITANIUM

POWDERS, AND PROSPECTS FOR THEIR USE IN INDUSTRY
R. K. Ognev et al 17 Jul. 1970 15 p refs Transl. into ENGLISH from Poroshk. Met. (USSR), 1968 p 10–17 Presented at the 9th All-Union Conf. on Powder Metallurgy, Riga, 1968
(AD-711181; FTD-HT-23-390-70) Avail: NTIS CSCL 11/6

The development of titanium powder metallurgy has imposed new demands on the quality of the initial powders whose properties, especially purity, form, and particle size, vary within a wide range depending on the method of their production. At present, titanium production is developing in the following basic directions: reduction of titanium from its oxides and halide compounds; electrolysis and electrolytic refining of wastes; vacuum distillation of titanium vapors for obtaining high-purity powders; various ways of grinding titanium sponge and titanium-containing materials, including titanium hydrides, with their subsequent degassing; or by a combination of these processes. The reduction of titanium chlorides by magnesium, calcium, or lithium involves griding the reaction products and leaching them with nonaqueous solutions (alcohol, acetone, etc.), which complicates the technological system of producing the powders and has a negative effect on their properties. Author (TAB)

N71-10889# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF (BaSr)TiO3 SOLID SOLUTIONS FROM WATER-SOLUBLE COMPONENTS
R. V. Devlikanova 26 Jun. 1970 8 p refs Transl. into ENGLISH from the Russian report
(AD-711176; FTD-HT-23-310-70) Avail: NTIS CSCL 7/2

The report presents the results of research to discover the optimal conditions for obtaining the named solid solutions with a strictly prescribed ratio of barium and strontium in them within the limits (Ba(0.9-0.5), Sr(0.1-0.5)TiO3. A series of tests was conducted to develop the influence of temperature (10, 25, 40, 60, and 80C) and a surplus of strontium in the initial salt mixtures (1.75, 2.0, and 2.5 times) on the composition of (BaSr)TiO3 solid solutions. Author (TAB)

N71-10896# Scientific Translation Service, Ann Arbor, Mich.
INVESTIGATION OF THE RELATION BETWEEN THE STRUCTURE OF ZIRCALOY 2 AND ITS CORROSION BEHAVIOR IN STEAM AT 400 C UNDER PRESSURE
P. Lelong et al [1970] 18 p refs Transl. into ENGLISH from Metall. (West Ger.), Sep. 1969 p 897–903 Prepared for Bettis Atomic Power Lab.
(WAPD-Trans-130) Avail: NTIS

The corrosion behavior of Zircaloy-2 in water or water vapor at higher temperatures under pressure depended not only on its composition, but also on surface and structural conditions. This was shown on industrial Zircaloy-2, forged and rolled to required dimensions, which was examined after heat treatment at 0.00001 torr. The cooling was first slowly performed (150 C/hr) and then rapidly (100 C/min). The velocity of the cooling determined the subsequent behavior of the alloy. The microscopic examination was made after electrolytic polishing with a high resolution microscope. The transition temperatures were determined by dilatometric measurements. Ratio and conversion velocity of alpha- and beta-components and their relation to the X-phase were strongly influenced by the rapidity of cooling. After the alloy had remained 14 days in 400 C water vapor it showed weight increase due to the formation of an oxide layer of 2 to 3 microns. A close relation between eutectoid separations and dilatometric expansions was also microscopically visible. NSA

N71-10899# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF HEAT TREATMENT ON THE WEAR RESISTANCE OF A NICKEL-PHOSPHOROUS COATING
N. Bezerbekov et al 18 Nov. 1969 10 p refs Transl. into ENGLISH from the publ. "Fizicheskiye Svoystva Dielektricheskikh i Poluprovodnikovykh Kristallov" Frunze, Ilim, 1967 p 49–51
(AD-711271; FTD-MT-24-327-69) Avail: NTIS CSCL 11/3

Steel 45 was coated in acid solution with Ni-P coating. Afterwards specimens were held for 1 hour each in electro-vacuum furnace at 200, 350, 400, 450, 500, and 600 degrees. The wear resistance under load of 30-70 kg was determined on a rotating machine MI (rate of revolution 0.47 m/sec) by using as control the gray cast iron specimens. The weight was determined before and after each 1000 m wear length. The wear was (C 30, 45, and 70 kg loads): at 400 degrees 0.6,1.,1.4; at 500 degrees 2.3, 4.2, 5.6; at 600 degrees 3.1, 5.4, 8.1 mg. weight loss. Heat treatment had significant effect on the physical properties of Ni-P coating; the wear resistance is highest after heat treatment at 400 degrees. Author (TAB)

N71-10940# Scientific Translation Service, Ann Arbor, Mich.
DEVELOPMENT OF TERNARY URANIUM ALLOYS WITH A LOW ALLOYING CONTENT (U-Nb-Cr, U-Nb-Fe, U-Nb-Ni, U-Nb-Si, U-Nb-Zr)
M. R. Bastelli et al [1970] 66 p Transl. into ENGLISH of EURATOM report EUR-4384.I Prepared for ORNL
(ORNL-tr-2325; EUR-4384.i) Avail: NTIS

Studies were made on the development of ternary uranium alloys whose irradiation behavior would, if possible, be better than that of U–1% Mo alloys. The work on the U–Nb–X ternary alloys included studies on beta-quenched and tempered U–1% Nb–0.15–0.25% Cr alloys. Laboratory tests showed that these alloys have good structural stability at 550 C, better mechanical resistance in the cold and in the hot (550 C) state than that of traditional alloys, and better thermal cycling resistance (0 to 550 C). Creep resistance was higher when the chromium content was low (0.15% Cr). The U–1% Nb–0.15% Cr alloy is to be subjected to in-pile irradiation. Author (NSA)

N71-10986# Oak Ridge National Lab., Tenn.
VOIDS IN RE-IRRADIATED ALUMINUM
N. H. Packan Jun 1970 14 p refs Submitted for publication
(Contract W-7405-eng-26)
(PB-192685; ORNL-TM-2976) Avail: NTIS CSCL 11F

High-purity aluminum irradiated to a fast fluence of (3 × 10 to the 20th power) neutrons/sq cm) (E > 0.82 MeV) at approximately 55C was annealed to remove all structural damage visible in the electron microscope, and was re-irradiated to the same fluence at the same irradiation temperature. Voids in the re-irradiated material were smaller and twice as numerous as those produced by the original irradiation. The dislocation loop structure was unchanged, but the re-irradiated material showed a pronounced increase in microhardness, ascribable in part to the greater density of voids. The observations on the voids are explained qualitatively by assuming either that submicroscopic remnants of the original voids survived the anneal and served as pre-existing nuclei for voids in the re-irradiation, or that dissolved solid or gaseous transmutation products enhanced void nucleation during the re-irradiation. Author (USGRDR)

N71-10987# Massachusetts Inst. of Tech., Cambridge, Mass.
SOME OBSERVATIONS OF DIFFUSIONAL FLOW IN A SUPERPLASTIC ALLOY
Anwar-ul Karim and Walter A. Backofen Sep 1970 19 p refs
(Contracts N00019-70-C-0071; N00014-67-A-0204-0015)
(AD-711348) Avail: NTIS CSCL 11/6

A metallographic study was made of the denuded zones from diffusional flow in a hydrided alloy of magnesium with 6 w/o Zn and 0.6 w/o Zr (ZK 60). At the deformation temperature of 450C, with an initial grain size of 18 micrometers, the alloy was superplastic. Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 08 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-10022# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Fluid Dynamics Facilities Research Lab.

THE STATIC AND DYNAMIC ELASTIC MODULI, REAL MODULI, OF GLASS FIBER-EPOXY AND BORON FIBER-ALUMINUM COMPOSITES Final Report

Marion G. Pottinger Jun. 1970 35 p refs

(AD-710598; ARL-70-0096) Avail: NTIS CSCL 11/4

Measurements of the elastic modulus and real modulus of glass fiber-reinforced epoxy and Boron fiber-reinforced aluminum were made by several methods and compared with values from the literature. Static bending, longitudinal pulse propagation in a bar, and longitudinal resonance of a bar were the experimental methods used. The results were compared with static bending, static tension, dynamic bending, and theoretical static values of the elastic moduli taken from the literature. The basic conclusion is that well determined static moduli can be used in dynamic studies of the two materials considered in the report. Author (TAB)

N71-10033# Boeing Scientific Research Labs., Seattle, Wash. Polymer Sciences Lab.

POLYQUINOXALINES

Paul M. Hergenrother May 1970 41 p refs Presented at High Temp. Polymer, Reinforcements and Composites Program, Polymer Conf. Ser., Salt Lake City, Jun. 1970

(AD-710504; D1-82-0969) Avail: NTIS CSCL 11/9

Polyquinoxalines are a relatively new class of polymeric materials which exhibit high oxidative, thermal and hydrolytic stability. Preliminary evaluation in structural application has demonstrated that the polyquinoxalines are potentially useful as adhesives, coatings and laminating resins. They are currently being evaluated for application as a high temperature adhesive for titanium. The report constitutes a summary review of linear non-ladder type quinoxaline polymers. It was prepared as an invited lecture presented at the High Temperature Polymer, Reinforcements and Composites Program, Polymer Conference Series, University of Utah, in June 1970. Author (TAB)

N71-10048*# Denver Research Inst., Colo.

INVESTIGATION TO DEVELOP A PROCESS FOR PRODUCTION OF OXIDE FIBERS BY MELT DRAW TECHNIQUE Final Report

Henry E. Otto and Dwight G. Moore 15 Jul. 1970 40 p refs

(Contract NAS3-13201)

(NASA-CR-72762) Avail: NTIS CSCL 11B

A melt-drawing process was investigated as a possible technique for preparing high-strength, high-modulus fibers of polycrystalline alumina. Fibers were formed by drawing small-diameter thoriated tungsten wires through a bath of molten oxide. Variables investigated included wire size, immersion time, oxidation state, and melt composition. It was found that oxidizing conditions were required to achieve wetting; also, that fast drawing speeds were necessary to prevent the molten oxide from coalescing into a series of small beads on the tungsten filaments. Tensile strengths of prepared fibers were as high as 134,800 psi at room temperature and 75,500 psi at 2000 F. The alumina sheath contributed little or nothing to the strength of fibers formed on a 5-mil tungsten core; however, the oxide sheath on a 1-mil tungsten core increased the load bearing capacity of the fiber by as much as a factor of five. Author

N71-10049*# Whittaker Corp., San Diego, Calif. Research and Development Div.

INVESTIGATION TO DEVELOP A CORE SHEATH PROCESS FOR PRODUCTION OF OXIDE FIBERS Final Report

Stanley Freske 5 Aug. 1970 36 p refs

(Contract NAS3-12434)

(NASA-CR-72758) Avail: NTIS CSCL 11D

The feasibility of manufacturing an oxide fiber with a core-sheath configuration was investigated. Both large and small diameter fibers possessing high strength and outstanding creep resistance at 2000 F (1100 C) were produced. To manufacture these high performance fibers required the addition of alumina to the glass sheath composition to prevent formation of mullite in the core. The metal used in the fiber forming equipment was critical. Chemical composition and crystalline structure of the ceramic core were determined and the tensile strength of the fiber as affected by test temperature and previous heat treatment was evaluated. Author

N71-10062# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.

EXACT SOLUTIONS FOR RECTANGULAR BIDIRECTIONAL COMPOSITES AND SANDWICH PLATES Technical Report, Jul.–Oct. 1969

N. J. Pagano Jun. 1970 37 p refs

(AD-710615; AFML-TR-69-324) Avail: NTIS CSCL 11/4

In a continuing study, three-dimensional elasticity solutions are constructed for rectangular laminates with pinned edges. The lamination geometry treated consists of arbitrary numbers of layers which can be isotropic or orthotropic with material symmetry axes parallel to the plate axes. Several specific example problems are solved, including a sandwich plate, and are compared to the analogous results in classical laminated plate theory. Author (TAB)

N71-10070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF NATURAL CHEMICAL IMPURITIES AND CRYSTALLITE ORIENTATION ON THE EROSION BEHAVIOR OF ARTIFICIAL GRAPHITE

Howard G. Maahs Washington Nov. 1970 34 p refs

(NASA-TN-D-6023; L-6792) Avail: NTIS CSCL 11B

The effects of natural chemical impurities and crystallite orientation on the erosion behavior of several artificial graphites were determined in a Mach 2 airstream with a stagnation point pressure of 5.6 atm and a nominal total enthalpy of 2.27 MJ/kg. The presence of natural chemical impurities caused higher surface temperatures and erosion rates, whereas differences in crystallite orientation had little effect on erosion rate provided the surface temperatures for the different orientations were the same. However, since the thermal conductivity of graphite depends on crystallite orientation, the surface temperatures of those graphites tested while contacting a heat sink varied with orientation. Higher temperatures were attained by the graphites when the across grain direction of the graphite was in contact with the heat sink; accompanying these higher temperatures were higher erosion rates. Because the observed erosion rates were much slower than diffusion control predictions and, in addition, were a function of surface temperature, it was reasoned that erosion was not controlled solely by diffusion but that reaction kinetics was still playing an important role in determining erosion rate. Author

N71-10072# Avco Government Products Group, Lowell, Mass. Applied Technology Div.

DEVELOPMENT OF NONDESTRUCTIVE TESTS FOR THE EVALUATION OF BONDED MATERIALS, 21 NOVEMBER 1968–20 JULY 1969

G. E. Lockyer and E. A. Proudfoot 20 Jul. 1969 50 p refs

(Contract N00156-69-C-0913; ARPA Order 1247)

(AD-709962; AVATD-0123-69-CR) Avail: NTIS CSCL 14/2

Commercial and military use of adhesive fastening is wisespread and continues to grow rapidly. This growth is indicative of the significant advantages of adhesive bonding over other fastening methods, in that it proceeds in the face of many disadvantages. Current adhesive systems are designed to be forgiving of some latitude in processing, but substandard bonds do occur, and these cannot be tolerated in critical applications. The extent of controls and tests necessary to assure highly reliable adhesive

bonds does not appear to be generally appreciated in that many presently available procedures are often ignored. Nondestructive testing can contribute to the production of more reliable adhesive bonds by (1) providing rapid, economical tests for in-process measurement and control to supplement and replace some of the lengthy destructive procedures now required, and (2) providing a non-contaminating means to evaluate the suitability of surfaces for bonding. Based on bonding theory, it appears that this latter may best be done through development of a rapid means to determine the work function of surfaces compatible with production requirements. Author (TAB)

N71-10159# Royal Radar Establishment, Malvern (England).
THE USE OF SPECIAL INFRA-RED REFLECTIVE PAINT SCHEMES TO REDUCE THE HEATING EFFECTS OF SOLAR RADIATION
P. W. Baker *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p ref (See N70-10126 01-34)
Copyright. Avail: NTIS

Experiments were made using special paint schemes, aimed at reducing the heating effects of solar radiation, while preserving an acceptable visual camouflage effect. Paint samples, prepared on 3 in. square aluminum plates, were assessed using a 10 kW Xenon arc lamp as the radiation source, with filters to correct the ultra-violet spectrum. Typical results are given for normal and IR reflective dark green and light stone paint systems, with comparison against matt black and gloss white paints. Author

N71-10174# Avco Corp., Lowell, Mass. Applied Technology Div.
DEVELOPMENT OF NONDESTRUCTIVE TESTS FOR THE EVALUATION OF BONDED MATERIALS Quarterly Progress Report, 20 Jul. – 19 Oct. 1969
John R. Zurbrick 19 Oct. 1969 19 p refs
(Contract N00156-69-C-0913; ARPA Order 1247)
(AD-709963; AVATD-0175-69-CR; QPR-3) Avail: NTIS CSCL 14/2

A program plan for the current funding period, progress in the surface condition study, and the results of further investigation into using the exo-electron phenomenon for the purposes of nondestructive surface characterization are discussed. Author (TAB)

N71-10189# Avco Corp., Wilmington, Mass. Systems Div.
DEVELOPMENT OF NONDESTRUCTIVE TESTS FOR THE EVALUATION OF BONDED MATERIALS Quarterly Progress Report, 20 Jan. – 19 Apr. 1970
John R. Zurbrick 19 Apr. 1970 28 p refs
(Contract N00156-69-C-0913; ARPA Order 1247)
(AD-709965; AVSD-0176-70-CR; QPR-5) Avail: NTIS CSCL 14/2

Data correlations and analyses for the Surface Condition Study are discussed. The basis for, and derivation of, an equation which provides the means to predict bond strength are presented. Results of feasibility studies for NDT techniques suitable to substrate surface characterization are discussed. Author (TAB)

N71-10241# Boeing Scientific Research Labs., Seattle, Wash.
AN INTRODUCTION TO ELECTRON-HOLE PLASMAS
Betsy Ancker-Johnson (Washington Univ., Seattle) Jun. 1970 96 p refs Sponsored in part by NSF
(AD-710478; D1-82-0983) Avail: NTIS CSCL 20/12

Lectures on electron hole plasmas are presented, covering transient properties, including theories with and without plasma trapping and with trapping and release; and steady state properties, including constant and density-dependent plasma lifetime theories in relation to nonequilibrium plasma production. Comparisons are made between observation and theory of sausage mode (m = 0) instability without applied magnetic fields and with an axial magnetic field. Feedback control of m = 0 oscillations is also mentioned. J.M.

N71-10302# Avco Corp., Lowell, Mass. Applied Technology Div.
DEVELOPMENT OF NONDESTRUCTIVE TESTS FOR THE EVALUATION OF BONDED MATERIALS Quarterly Progress Report, 20 Oct. 1969 – 19 Jan. 1970
John R. Zurbrick 19 Jan. 1970 56 p refs
(Contract N00156-69-C-0913; ARPA Order 1247)
(AD-709964; AVATD-009-70-CR; QPR-4) Avail: NTIS CSCL 14/2

Data obtained in the surface condition study are presented. Electric field reflectometry, at 1 KHz and 9.8 GHz, and gas-phase ultrasonic transmission methods are detailed as possible methods for nondestructively evaluating substrate surfaces. Author (TAB)

N71-10427*# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF CFA CARBONACEOUS ROCKET NOZZLE MATERIALS Final Report
R. J. Lockhart, S. A. Bortz, and M. A. Schwartz 20 Aug. 1970 79 p refs
(Contract NAS3-12043)
(NASA-CR-72766) Avail: NTIS CSCL 21H

A materials system of filler, binder, and additives was developed for use as a low-cost molding material in ablative nozzles for the 260-in. solid rocket motor. A petroleum coke and carbon black filler was used to improve density by controlling particle size distribution. A furfuryl ester resin was used for its high carbon residue after pyrolysis. Staple carbon fibers were incorporated to improve the strength and crack resistance of molded bodies. Physical and mechanical properties were measured. In static firing tests of two subscale nozzles, this material compared favorably in erosion rate with several other ablative systems. Author

N71-10496# Royal Australian Air Force Academy, Melbourne.
THERMAL COATING OF GONDOLA PAYLOADS
J. A. Thomas [1970] 8 p
(NYO-3747-12) Avail: NTIS

To help maintain equipment temperature in high altitudes to that of the laboratory, the radiative properties of the coatings of gondola payloads are investigated. Flight tests were carried out to determine the actual equilibrium temperatures. Aluminum cans with a variety of coatings were used. The recorded temperatures are in good agreement with the values obtained from radiosonde data. E.H.W.

N71-10590*# Cincinnati Univ., Ohio.
THERMODYNAMIC PROPERTIES OF TERNARY REFRACTORY CARBIDES. 3: ZIRCONIUM-HAFNIUM-CARBON Technical Report, 1 Jul. 1967 – 30 Jun. 1969
Michael Hoch and S. Yamauchi Wright-Patterson AFB, Ohio AFML Dec. 1969 30 p refs
(Grant NGR-36-004-014; Contract F33615-67-C-1585)
(NASA-CR-111120; AD-701394; AFML-TR-69-209-Pt-3) Avail: NTIS CSCL 11/2

The thermodynamic properties of ternary zirconium-hafnium carbide having the sodium-chloride type structure were studied, using the time-of-flight mass spectrometer. The ratios of the activities of the components were measured as a function of composition at 2440 K. From the variation of the ratio of activities with composition, the pairwise interaction energies were obtained. The metal-metal interaction energy = 1.0 + or – 0.3 kcal/mole, is similar to that in the body-centered cubic zirconium-hafnium metallic system. The difference between the zirconium-carbon and hafnium-carbon interaction energy is a function of composition. Author

N71-10597# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNERGISTIC EFFECT OF ADDITIVES DURING COLLOIDAL DISSOLUTION

A. B. Vipper et al 2 Jul. 1970 9 p refs Transl. into ENGLISH from the publ. 'Trudy, 2d Vsesoyuznoe Nauchno-Tekhnicheskoye Soveshchaniye po Prisadkam k Maslam, 1966' Moscow, 1968 p 187–89

(AD-711152; FTD-HT-12-344-70) Avail: NTIS CSCL 11/8

Tests show that when using a mixture of detergent and antioxidant additives the most unexpected results are possible. A solution to this problem would considerably simplify the selection of the composition of additives for oils which satisfy the requirements imposed by modern supercharged internal combustion engines. On the basis of the above, the solubilization ability of detergent and antioxidant additives and mixtures of them were tested. The ability of the additive to increase solubility was evaluated from the intensity of the colloidal dissolution of the dye Rhodamine C in isooctane. Detergent additives belonging to compounds such as succinimides and copolymers, and also barium phosphate were studied; the antioxidant additive was zinc dieryl dithiophosphate. TAB

N71-10629# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GELATINIZATION OF ORGANOSILICON LIQUIDS UNDER FRICTION

K. I. Klimov et al 8 Jul. 1970 13 p refs Trans. into ENGLISH from the publ. 'Nauchnyye Printsipy i Novyye Metody Ispytaniy Materialov dlya Uzlov Treniya' USSR, 1968 p 140–144

(AD-711174; FTD-MT-24-101-70) Avail: NTIS CSCL 11/8

The stability of organosilicon liquids (I) was evaluated in a 5-ball modified friction testing apparatus. The tests were run at 200 degrees under axial loading of 100 kg and 2000 rpm. Test results showed that the stability of I under friction was inconsistent with results obtained from tests under static conditions, suggesting that lubricants for rolling friction should be tested by different criteria. The stability of I during mechanodynamic tests increased in a given order. Fluorine containing I exhibited the highest stability, i.e., its viscosity remained essentially unchanged after 20 hrs. operation. Author (TAB)

N71-10632# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PRODUCTION OF HEAT-RESISTANT COATINGS OF TITANIUM AND MOLYBDENUM IN ALUMINUM BASE METALS

P. F. Shulenok 7 Jul. 1970 17 p refs Transl. into ENGLISH from the publ. 'Vysokotemperaturnyye Pokrytiya Seminar po Zharostoykim Pokrytiyam' Moscow, Izd. Nauka, 1967 p 126–134

(AD-711173; FTD-MT-24-113-70) Avail: NTIS CSCL 11/3

The article describes methods of producing heat-resistant coatings on such metals as titanium and zirconium, niobium and tantalum, molybdenum and tungsten for protection against high-temperature oxidation. Author (TAB)

N71-10662# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL INVESTIGATION OF ANISOTROPY OF FIBERGLASS-REINFORCED PLASTICS

Ya. S. Sidorin 28 May 1970 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. i Mashinostr. (Moscow), no. 3, 1964 p 122–126

(AD-710345; FTD-HT-23-208-70) Avail: NTIS CSCL 11/9

Results of experimental investigation of properties of a cold-cured fiberglass-reinforced laminate (21 layers per cm) consisting of an ASTT(b)-S sub 2 satin-woven fiberglass cloth and a PN-1 unsaturated polyester resin (50 to 50 ratio by weight) are presented. A regularity pattern in variation of mechanical properties of the laminate was studied in relation to the angle phi between the warp direction and longitudinal axis of the specimen. Tubular (30 mm i.d., 3 mm wall thickness) and flat 20 x 3 mm specimens were tested at phi equals 0 to 90 degrees in 15 degree intervals. The elasticity modulus, Poissons ratio, ultimate strength, and elongation were measured and compared with theoretical values obtained by applying the relations of the elasticity theory of an orthotropic solid with three planes of elastic symmetry. The results obtained are plotted in diagrams and show that the flat specimens have lower values of all characteristics and give an incorrect idea on performance of structural components made of fiberglass-reinforced plastics within the whole construction. The use of tubular specimens instead of the flat ones is recommended in investigating the mechanical properties of fiberglass-reinforced plastics. Author (TAB)

N71-10683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF THE VISCOSITY AND CHEMICAL COMPOSITION OF THE DISPERSION MEDIUM ON THE STRUCTURE AND PROPERTIES OF LITHIUM GREASES

I. G. Fuks et al 26 Jun. 1970 14 p refs Transl. into ENGLISH from Nefteperab. Neftekhim. (Moscow), no. 4, 1969 p 19–33

(AD-711177; FTD-HT-23-313-70) Avail: NTIS CSCL 11/8

The maximum thickening effect of Li stearate (I) was produced in the oil S-220. The form and the size of the particles were changed when aromatic hydrocarbons were present in the medium. An optimum concentration of aromatic hydrocarbons increased greatly the thickening effect of the soap. The low-temperature properties of the grease could thus be improved by varying the chemical composition of the medium. The characteristics of various media and greases and the effect of aromatic hydrocarbons on the Li grease properties are tabulated. Author (TAB)

N71-10722# National Bureau of Standards, Washington, D.C.

PRICE AND AVAILABILITY LISTING OF STANDARD REFERENCE MATERIALS, SUPPLEMENT

Jul. 1970 14 p refs

(NBS-260-Suppl) Avail: Issuing Activity

A price and availability listing of standard reference materials is presented. The listing consists of four parts: (1) all currently available standard reference materials (SRM) arranged by SRM number, (2) description of SRMs issued since effective date of current catalog, (3) list of SRMs which have gone out of stock, and (4) changes in policy, ordering, shipping, and information of a general nature. Author

N71-10740*# Cincinnati Univ., Ohio.

THERMODYNAMIC PROPERTIES OF TERNARY REFRACTORY CARBIDES. PART 1: ZIRCONIUM-NIOBIUM-CARBON Technical Report, 1 Jul. 1967 – 30 Jun. 1969

C. K. Jun and Michael Hoch Wright-Patterson AFB, Ohio AFML Jun. 1969 45 p refs

(Grant NGL-36-004-014; Contract F33615-67-C-1565)

(NASA-CR-111123; AD-700765; AFML-TR-69-209-Pt-1) Avail: NTIS CSCL 11B

The non-stoichiometry of zirconium-niobium-carbide with the sodium-chloride type structure, Zr(x)Nb(1-x)C(y), was studied by measuring the activities of the components as a function of composition. The samples were prepared by heating the required amounts of oxides and graphite in a high vacuum induction furnace. Lattice parameters were measured of all specimens. At constant carbon concentration (y = constant), the lattice parameter deviates from Vegard's law at the niobium-rich end. The metal-metal interaction energy is not much different from that in the bcc metallic zirconium-niobium system. The difference between the zirconium-carbon and niobium-carbon interaction energies (E(13)-E(23)) is linearly dependent on composition. Author (TAB)

N71-10758*# Los Alamos Scientific Lab., N.Mex.
CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Report, 1 Nov. 1969 – 31 Jan. 1970
Morton C. Smith 8 Apr. 1970 27 p refs Sponsored in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-111106; LA-4417; Rept-12) Avail: NTIS CSCL 11D

Research on carbon and graphite is reported for the effects of heat treatment on crystalline parameters of Santa Maria coke, characterization of the products of ground heat-treated Santa Maria coke, the production and properties of hot-molded Santa Maria graphite, extruded resin-bonded graphites, extruded anisotropic and fiber-reinforced molded graphites, elastic properties of Poco graphites, production of carbon foam, and the measurement of the lattice parameters of boronated graphites. NSA

N71-10761# Arizona State Univ., Tempe. Dept. of Chemistry.
OXYGEN TRANSPORT PROPERTIES OF RARE EARTH OXIDES
Leroy Eyring [1969] 13 p refs Presented at the Intern. Conf. on Heterogeneous Kinetics at Elevated Temp., Philadelphia, 8–10 Sep. 1969 Sponsored by AFC
(COO-1109-54; CONF-690927-2) Avail: NTIS

The usefulness of the rare earth oxides as model systems for studies which include material transport is pointed out. The results obtained in kinetics studies of these systems are sketched and the whole placed against the emerging understanding of nonmetallic solids having extended defects. Author

N71-10772* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METALLIC FILM DIFFUSION FOR BOUNDARY LUBRICATION Patent
Donald H. Buckley and Robert L. Johnson, inventors (to NASA) Issued 2 May 1967 (Filed 15 Oct. 1963) 4 p Cl. 117-65.2
(NASA-Case-XLE-01765; US-Patent-3,317,341; US-Patent-Appl-SN-316477) Avail: US Patent Office CSCL 11H

A method is described for diffusing a metallic film into metal, ceramic, and cermet surfaces for boundary lubrication in aerospace environments. The method consists of preparing the surface to be lubricated, applying liquid metals such as gallium, heating the surface with the metal film, cooling and polishing. A post heat treatment is also given. Tin, lead and indium can be added to the gallium to provide the metallic film lubricant with reduced corrosion properties. F.O.S.

N71-10831# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
A STUDY OF THE EFFECTIVENESS OF SELECTED ANTIWEAR ADDITIVES IN SYNTHETIC ESTERS Final Report, Jan. 1968–Jun. 1969
Kenneth A. Davis Jul. 1970 89 p refs
(AD-711667; AFML-TR-69-301) Avail: NTIS CSCL 11/8

The effectiveness of selected antiwear additives was evaluated using synthetic ester base stocks. Certain relations between chemical structure and effectiveness were determined. The investigations were conducted using the pin on disk apparatus developed by Wintershall/Beist. Di-, tri- and tetraester fluids were used in the investigation. The basic lubricity of the oils was found to increase with increasing molecular weight and viscosity. Additives containing chlorine, sulfur and phosphorus were investigated, as well as several organic acids and organometallic compounds. Phosphorus additives proved effective, while sulfur and chlorine containing materials showed little beneficial effect. Experiments using aliphatic acids showed long chain saturated acids to be more useful in decreasing wear than shorter chain or unsaturated acids. A limiting or optimum concentration for tricresylphosphate was determined. A series of experiments using alkyl- and arylphosphates showed their effectiveness to be related to their hydrolytic stabilities. The lower hydrolytic stability phosphates were most effective. Further experiments showed that the possible acidic impurities in tricresylphosphate are powerful antiwear additives. Certain organometallic compounds were found to have limited capability as antiwear additives. Overall results showed additives to have specific ranges of load over which they were effective, and proper selection of additives can result in an additive package to cover a wide load range. Author (TAB)

N71-10851# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATIONS OF ELASTIC PROPERTIES OF SOME PLASTICS AT HIGH PRESSURES BY THE ULTRASONIC PULSE METHOD
M. P. Volarovich et al 7 Aug. 1970 16 p refs Transl. into ENGLISH from Obrabotka Plastmass v Mashinostr. (Moscow), 1968 p 55–63
(AD-711761; FTD-MT-24-72-70) Avail: NTIS CSCL 11/9

Measurements were made of longitudinal and lateral elastic waves in specimens of plexiglass, polyfluoroethylene resin, textolite and AG-4S and RN-1 glass reinforced plastics at pressures up to 4000 kg/sq cm employing a pulse ultrasonic method developed for the study of the elastic properties of rock. Data on the linear relationship between the velocities of elastic waves and pressures were obtained for all plastics investigated. On the basis of experimental data the following elastic properties were calculated: Poissons coefficient, Youngs modulus, modulus of shear and compression. Functional expressions for these elastic properties are given. The investigation shows that at pressures of up to 4000 kg/sq cm plastics show linear changes in elastic parameters brought about by pressure. Author (TAB)

N71-10863# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THICKENING CAPACITY OF SILICA GEL IN PLASTIC LUBRICANTS
V. V. Veinshtok et al 22 Jul. 1970 14 p refs Transl. into ENGLISH from Neftepererabotka i Neftekhimiya (USSR), no. 6, 1969 p 20–24
(AD-711751; FTD-HT-23-312-70 Avail: NTIS CSCL 11/8

The authors studied the influence of moisture, chemically and physically bound by silica gel, on (the) thickening capacity of the gel and on the stability of silica gel (Si) lubricants. The lubricants were prepared on silica gel specimens, etherified by butanol and heat treated. Heating of the silica gel was required since Si lubricants on heat-resistant dispersion media are often used at temperatures of 250-350C. Author (TAB)

N71-10870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF TESTING OILS IN SINGLE CYLINDER ENGINES
V. F. Filippov et al 14 Aug. 1970 16 p refs Transl. into ENGLISH from the Russian report
(AD-711749; FTD-HT-23-284-70) Avail: NTIS CSCL 11/8

The reliability of testing of oils with additives in the Pitter AV-1 apparatus with a diesel engine for evaluation of detergent properties by the standard method PI 175/64 and in the Pitter W-1 apparatus with a carbureted engine for evaluation of stability and anticorrosive properties by the standard PI 176/64 method was discussed. The classification was practicable only with Heavy-Duty oils. The reproducibility was not satisfactory. The domestic IKM-40 Fah method allowed more distinct evaluation of the corrosivity of oils, and the IKM-1 as well as IDM-1 apparatus showed the following advantages over the Pitter W-1 and AV-1 engines: simple maintenance and reliable performance, high sensitivity and reproducibility, and distinct classification of oils up to the Series No. 3 inclusively. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N71-10009# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
A COMPARISON OF TWO QUADRATIC PROGRAMMING ALGORITHMS
Gerald L. Hefley and M. E. Thomas Jun. 1970 20 p refs
(Contract DAHC04-68-C-0002; Proj. Themis)
(AD-710227; THEMIS-UF-TR-41; AROD-T-1-55-RT) Avail: NTIS CSCL 12/2

The paper compares Wolfes quadratic programming algorithm with Cottle and Dantzigs principle pivot method. It is shown that Wolfes algorithm requires more operations. Author (TAB)

N71-10037# Communications Research Centre, Ottawa (Ontario).
THE ZOOM TRANSFORM
A. W. R. Gilchrist Jun. 1970 16 p refs
(CRC-TN-631) Avail: NTIS

The zoom transform is the discrete Fourier transform of the discrete Fourier transforms of successive sections of a sampled signal. An analysis of the zoom transformation is presented, which shows that this process is approximately equivalent to a single Fourier transformation of all the signal samples. The predictions of the analysis were verified by computer tests. Correction factors are derived for the phase and amplitude of the zoom transform. In comparison with the large single transformation, the zoom technique offers important savings in storage capacity requirements, and, in applications where high-resolution analysis of only selected regions of the spectrum is required, the amount of computation needed may be greatly reduced. Author

N71-10195# Naval Postgraduate School, Monterey, Calif.
A THEORY OF GENERALIZED FILTERS
Freddie LeRoy Lynn, Jr. (M.S. Thesis) Jun. 1970 64 p refs
(AD-709949) Avail: NTIS CSCL 12/1

This manuscript is a collection of many of the known results in the theory of generalized filters (Sigma-filters) as well as an extension of some of the work in this area. The relation of Sigma-filters to compactifications and realcompactifications is given special attention. Special emphasis is also given to the concept of tracing. After the necessary preliminaries are disposed of, Section I motivates the study of Sigma-filters by discussing the collection of zero-sets and then the Wallman compactification. The concept of realcompactification is also mentioned. Section 2 introduces the concept of Sigma-filters and exhibits many of the elementary facts about these generalized filters. The beginning of Section 3 deals with the convergence of Sigma-filters. The Frink or Wallman-type compactification of a Tychonoff space is presented in detail. The generalization of this method in constructing realcompactifications in Tychonoff spaces is also discussed. The Section closes with the presentation of some tracing results. Finally, Section 4 investigates the concept of Sigma-continuity. Author (TAB)

N71-10254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION AND ANALYSIS: DATA SYSTEM DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 10–16 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 12A

The incomplete gamma functions are defined and expressed in various forms for application to stochastic processes in structural mechanics, probability calculations in statistics, and study of droplet size distribution in material science. The important properties of the functions are summarized and an algorithm for use in a general purpose program is discussed. Truncated Chebyshev polynomial approximations for solution of the Lane-Emden equation are also considered. R.B.

N71-10327*# Stanford Univ., Calif. Dept. of Operations Research.
LECTURES ON CONTROLLABILITY AND OBSERVABILITY
R. E. Kalman Apr. 1970 150 p refs Presented at Seminar on Controllability and Observability, Bologna, 1–9 Jul. 1968
(Grant NGR-05-020-073; Contract AF 49(638)-1440)
(NASA-CR-111112; AD-704617; AFOSR-70-1027TR) Avail: NTIS CSCL 12A

The lectures, delivered at the seminar of Centro Internazionale Matimatico Estivo on controllability and observability in Bologna, Italy, constitute an authoritative review of the main results of the theory of controllability with observability together with a very modern introduction to algebraic system theory. The notes also contain a historical appendix comparing the contributions of the Russian and American school. Author (TAB)

N71-10328# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
APPLICATION OF DIFFERENTIAL GAME THEORY TO PURSUIT-EVASION PROBLEMS OF TWO AIRCRAFT
William L. Othling, Jr. (Ph.D. Thesis) Jun. 1970 118 p refs
(AD-711055; DS/MC/67-1) Avail: NTIS CSCL 12/2

The pursuit-evasion aspect of the two aircraft combat problem is introduced as a fixed time, zero sum, perfect information differential game. A realistic aircraft model is presented for which a solution of this combat problem is desired. Because of the non-linear dynamics associated with this model, an optimal closed-loop solution cannot be obtained. Three additional simplified aircraft models are introduced as approximations to the realistic model. Optimal solutions and closed-loop control laws are obtained for each of these models. Analysis of these solutions and control laws enables the formulation of an approximate closed-loop control law for use with the original realistic model. Author (TAB)

N71-10359*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
ON THE UNIFORM ASYMPTOTIC STABILITY OF FUNCTIONAL DIFFERENTIAL EQUATIONS OF THE NEUTRAL TYPE
J. K. Hale and A. F. Ize (Sao Paulo Univ.) Jun. 1970 15 p refs Sponsored in part by Conselho Nacional de Pesquizas and Fund. de Amparo a Pesquisa do Estado de Sao Paulo
(Grants NGL-40-002-015; AF-AFOSR-693-67; AF-AFOSR-693-67B)
(NASA-CR-111113; AD-708142; AFOSR-70-1766TR) Avail: NTIS CSCL 12A

The relationship between the uniform asymptotic stability of a linear neutral differential equation and a perturbed equation is studied. With the assumption that there exists a continuous, non-negative, nondecreasing function, it is shown that the perturbed equation is also asymptotically stable. F.O.S.

N71-10376*# Brown Univ., Providence, R.I.
A CLASS OF NEUTRAL EQUATIONS WITH THE FIXED POINT PROPERTY
Jack K. Hale Jun. 1970 6 p refs
(Grants NGL-40-002-015; AF-AFOSR-693-67B)
(NASA-CR-111114; AD-708145; AFOSR-70-1780TR) Avail: NTIS CSCL 12A

For a neutral functional differential equation with a stable operator D, it is shown that the solution operator is the sum of a contraction and a completely continuous operator. Author (TAB)

N71-10396 Royal Greenwich Observatory, Herstmonceux (England).
THE VAN DER HELD CURVES OF GROWTH
A. L. T. Powell 1969 25 p refs Prepared in cooperation with Royal Obs., Cape Town *Its* Bull. No. 152
Copyright. Avail: HMSO 4s; BIS $0.80

Thirty-one van der Held theoretical curves of growth were computed for a range of the damping constant (a) from 0.0005 to 0.5 in equal logarithmic intervals. The curves are normalized with a total Doppler broadening parameter of 1.69 km/s, which corresponds approximately to the solar curve of growth derived by Cowley and Cowley. Author

N71-10439*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CALCULATION OF THE PROFILES OF THE STOKES PARAMETERS AND THE DEGREE OF LINE POLARIZATION: AN APPLICATION OF THE SOLUTIONS OF MOE TO THE UNNO TRANSFER EQUATIONS
M. J. Hagyard 10 Aug. 1970 34 p refs
(NASA-TM-X-64541) Avail: NTIS CSCL 12A

An outline is given of the solutions of Olav K. Moe to the Unno transfer equations for the Stokes parameters. The application of these solutions to the calculations of the profiles of the Stokes parameters and to the calculations of the degrees of linear and circular polarization using a narrow-band birefringent filter is described in detail. Numerical results for the iron line 5250.22 A using the photospheric model of Holweger are presented. Author

N71-10484# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A GENERAL FINITE-DIFFERENCE APPROXIMATION FOR A GENERAL DOMAIN. PART 2: A NUMERICAL METHOD FOR SOLVING GENERAL MHD DUCT FLOW PROBLEMS Final Report
W. H. Chu 26 Aug. 1970 60 p refs
Avail: NTIS

A numerical method is successfully developed for solving general MHD duct flow problems, utilizing machine transformation and finite-difference technique with a new successive overrelaxation procedure. Examples are given to establish the method and to indicate the versatility of the associated computer program. The generality of the basic principle may help to solve many problems other than MHD flow in a general domain. Author

N71-10498# North Carolina Univ., Chapel Hill. Inst. of Field Physics.
THE MANY-UNIVERSES INTERPRETATION OF QUANTUM MECHANICS
Bryce S. DeWitt [1970] 83 p refs Presented at the Intern. School of Phys. 'Enrico Fermi', Varenna, Italy, Jul. 1970 Sponsored by NSF
Avail: NTIS

An interpretation of quantum mechanics due to a previous interpretation by Everett is presented. The interpretation asserts the following: (1) the mathematical formalism of quantum mechanics is sufficient as it stands and no metaphysics needs to be added to it; (2) it is unnecessary to introduce external observers or to postulate the existence of a realm where the laws of classical physics hold sway; (3) it makes sense to talk about a state vector for the whole universe; (4) this state vector never collapses, and hence the universe as a whole is rigorously deterministic; (5) the ergodic properties of laboratory measuring instruments, although strong guarantors of the internal consistence of the statistical interpretation of quantum mechanics, are inessential to its foundations; and (6) the statistical interpretation itself need not be imposed a priori. Two postulates based on the mathematical content of the quantum formalism and the complexity of the real world are derived in order to arrive at the given assertions. Based on the two postulates, the metatheorem that the mathematical formalism of the quantum theory is capable of yielding its own interpretation is proved. Author

N71-10506# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
TIME SERIES ANALYSIS: THEORY AND PRACTICE
R. Mejia and C. Chang (Computer Usage Corp., Bethesda, Md.) Jun. 1970 132 p refs
(TR-4) Avail: Issuing Activity

Computer programs which were developed and arranged into a cohesive library are described. The language of time series as well as the more pertinent considerations in collecting and preparing data for analysis are introduced. The mathematical techniques made available are described briefly along with their applicability under various circumstances. Programs are written up individually, and their use via a sophisticated calling program is reviewed. Author

N71-10538*# Southern Methodist Univ., Dallas, Tex.
GENERALIZATION OF RATIO ESTIMATE FOR POPULATION TOTAL
John E. Walsh [1969] 15 p ref Sponsored in part by Mobil Res. and Develop. Corp.
(Grant NGR-44-007-028; Contract N00014-68-A-0515)
(NASA-CR-111127) Avail: NTIS CSCL 12A

It is desired to estimate the total Y for a finite population (of size N) with unknown values. A population with corresponding known values is available. Also, a simple random sample of size n is taken from the unknown population. Let barred y be the mean of the sample while barred x is the mean of the n values from the known population that correspond to these sample values. The ratio estimate of Y is generalized to the form NXy/(Ax + (1 − A)X), where barred X is the mean of the known population. Use of A = A sub o suitably chosen yields an estimate that approximately is unbiased and has as small a variance as is attainable for a linear regression estimate. When A sub o is unknown in advance, it can be estimated (denoted by A' sub o). Use of A' sub o and a mild modification yields an estimate with the favorable properties occurring for A sub o. An estimate is developed for the standard deviation of the estimate using A' sub o. Some comparisons are made with the linear regression estimate. Author

N71-10539*# State Univ. of New York, Stony Brook. College of Engineering.
ON THE DAVIDON-FLETCHER-POWELL METHOD FOR FUNCTION MINIMIZATION
R. P. Tewarson 1 Jul. 1969 14 p refs
(Grant NGR-33-015-013)
(NASA-CR-111129; Rept-140) Avail: NTIS CSCL 12A

A method for improving the computations in the Davidon-Fletcher-Powell method for function minimization is suggested. It utilizes the doubly relaxed generalized inverse of the matrix which is usually obtained from the gradient vectors. The method consists of simple perturbations in the scalar terms of the correction matrix. Author

N71-10540*# Ohio State Univ. Research Foundation, Columbus. Dept. of Mathematics.
NONPARAMETRIC RANKING AND SELECTION PROCEDURES Final Report, 1 Oct. 1968 – 30 Sep. 1969
M. Haseeb Rizvi 30 Sep. 1969 8 p
(Grant NGR-36-008-040; RF Proj. 2241)
(NASA-CR-111132; FR-5) Avail: NTIS CSCL 12A

Research and development of nonparametric methodology in the area of statistical ranking and selection procedures is reported. A critical analysis of certain multiple-decision procedures

based on rank sums was carried out. The procedures are proposed for analyzing data in a one-way layout having independent errors, the same known cumulative distribution function, and unknown theta values. R.B.

N71-10580*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
MATHEMATICAL PROGRAMMING AND THE CONTROL OF MARKOV CHAINS
H. J. Kushner and A. J. Kleinman [1970] 43 p refs
(Grants NGL-40-002-015; NSF GK-2788; AF-AFOSR-0693-67A)
(NASA-CR-111130; AD-706910; AFOSR-70-1483TR) Avail: NTIS CSCL 12A

Linear programming versions of some control problems on Markov chains are derived, and are studied under conditions which occur in typical problems which arise by discretizing continuous time and state systems, or in discrete state systems. Control interpretations of the dual variables and simplex multipliers are given. The formulation allows the treatment of 'state space' like constraints which cannot be handled conveniently with dynamic programming. The relation between dynamic programming on Markov chains, and the deterministic discrete maximum principle is explored, and some insight is obtained into the problem of singular stochastic controls (with respect to a stochastic maximum principle). Author

N71-10589*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLASSICAL ADIABATIC PERTURBATION THEORY
David P. Stern Oct. 1970 44 p refs Submitted for publication
(NASA-TM-X-65379; X-641-70-403) Avail: NTIS CSCL 12A

Methods of classical perturbation theory developed for small perturbations are extended to slowly (or adiabatically) perturbed systems, with slow dependence either on time or on dynamical variables. Specifically, the extension is performed for the canonical perturbation theory of Poincare and Von Zeipel, for the Krylov-Bogoliubov-Kruskal method of eliminating angle variables, for the general form of direct near-identity canonical transformations and for two of its realizations, based on the conventional generating function and on the Lie transform. In addition, the concepts of slow (or adiabatic) perturbations and of an implicit small parameter epsilon are clarified, as is the distinction between two alternative definitions of adiabatic invariance. Author

N71-10648# Naval Postgraduate School, Monterey, Calif.
SYMBOLIC ALGEBRAIC MANIPULATION BY DIGITAL COMPUTER IN PROBLEMS OF CONTROL THEORY
Klaus Peter Merzhaeuser (M.S. Thesis) Jun. 1970 95 p refs
(AD-709837) Avail: NTIS CSCL 12/1

A method of digital computer oriented analysis of a Mason flow graph is presented. Using this method in connection with a computer program implementing the algebraic manipulation language FORMAC can be a tool in expanding large determinants with symbolic polynomial elements and thereby finding the characteristic equation and transfer functions of a linear time-invariant system in symbolic form. Also a new approach to the root locus method is shown, using a FORMAC program. The advantages over the conventional root locus method are discussed. Areas of possible future use of FORMAC in algebraic problems of control theory are discussed. Author (TAB)

N71-10765# Wisconsin Univ., Madison
SOLVABILITY OF DIFFERENTIAL EQUATIONS IN THE SPACES GAMMA TO THE (DELTA) POWER (OMEGA)
David K. Cohoon Aug. 1970 34 p refs
(Contract N00014-67-A-0128-0014)
(AD-710428; Rept-5) Avail: NTIS CSCL 12/1

The report includes a detailed investigation of the properties of the Frechet space (Gamma sup (delta)) (Omega) of infinitely differentiable functions f on the open subset Omega in R sup n such that for every epsilon > 0 and every compact subset K of Omega (Norm f sup (epsilon, K)) = sup(epsilon to the power (-/alpha/)) (/alpha/ to the power (-/alpha/ delta)) /(D sup alpha) f(x)/: x(epsilon)K, alpha(epsilon)K, alpha(epsilon(N to the nth power)) is finite. TAB

N71-10820 Texas Univ., Austin.
A SERIES-PERTURBATION TECHNIQUE FOR EXTREMUM SOLUTIONS OF TWO-POINT BOUNDARY VALUE PROBLEMS
Ronald Dominic Slovikoski (Ph.D. Thesis) 1969 54 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-21888

A numerical technique is presented which generates approximate solutions to end-bounded dynamics problems involving the extremizing of a performance index, such as time. The technique requires an initial approximation to the solution, which is then perturbed by a series of orthogonal functions, such as trigonometric functions to determine the variation of the performance index in the neighborhood of the approximate solution. A better approximation to the actual solution is then generated by adding to the current approximation a summation of the perturbing functions with each weighted by the partial derivative of the performance index with respect to the amplitude of the respective perturbing function. The process is applied iteratively until it converges. Dissert Abstr.

N71-10821# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Systems Sciences Section.
ON THE CONVERGENCE OF RANDOM SEARCH ALGORITHMS IN CONTINUOUS TIME WITH APPLICATIONS TO ADAPTIVE CONTROL
Richard Gran Oct. 1970 20 p refs Presented at the 1970 IEEE Symp. on Adaptive Processes: Decision and Control, Austin, Tex., 7 – 9 Dec. 1970
(RE-396J) Avail: NTIS

In adaptive control systems, the control signals are derived in such a way that some performance criterion is minimized. That is, a quantitative measure based on engineering judgment of how well the system is performing is determined. This measure is such that the smaller the numerical value of the criterion the better. The control problem becomes a problem of determining the minimum of a function. One of the techniques for determining this minimum involves differentiating the function (calculating the gradient) and searching in the gradient direction until a minimum is found. A modification of the gradient search technique is considered where noise is added to the calculated nominal gradient direction, thereby perturbing the direction of the search. This approach was suggested for causing the search to converge sooner, and also for use in an adaptive control. It is shown that, in some cases, the introduction of noise will improve system operation in the sense that the minimum of the function being sought is reached sooner. Conditions that will permit the random search to converge to the smallest minimum of a function are derived. Author

N71-10834*# Texas A&M Univ., College Station. Inst. of Statistics.
A COMPUTER PROGRAM FOR THE MIXED ANALYSIS OF VARIANCE MODEL BASED ON MAXIMUM LIKELIHOOD
H. O. Hartley and W. K. Vaughn Aug. 1970 48 p refs
(Grant NGR-44-001-095)
(NASA-CR-111145; TR-3) Avail: NTIS CSCL 12A

A computer program is presented for an analysis of variance of unbalanced data assumed to arise from a mixed model. Specification of the model and the estimation theory by maximum likelihood are summarized along with the computational procedure developed. Examples are given in which the numerical procedure

is applied to obtain point estimates of the components of variance involved in the mixed model. The examples chosen comprise both situations for balanced data (when comparison will be made with conventional analysis of variance estimates) as well as unbalanced data. The comparisons for balanced data show excellent agreements for all those situations in which maximum likelihood estimation agrees with the analysis of variance estimates on theoretical grounds. Author

N71-10958# International Centre for Theoretical Physics, Trieste (Italy).
THE PHYSICS OF LOGIC
D. Finkelstein (Yeshiva Univ.) Jun. 1970 35 p refs Submitted for publication Sponsored in part by NSF Revised
Avail: Issuing Activity

The quantum theory implies a modification of the empirical logic of the real world, a revolution at a deeper level than that of general relativity but analogous in many ways. An operational or empirical logic is outlined to sharpen this statement. The path from this operational logic to conventional quantum theory in a complex Hilbert space is laid out. The process called second quantization, and which is not quantization at all, does in quantum logic what quantification does in classical logic and should be so called. Third, fourth, ...N sub O quantification are meaningful and are defined. Evasions of von Neumann's hidden variables theorem are constructed, analogous to the imbedding of curved space in a higher dimensional flat space, but the relevance of these to physics is doubled. Author

N71-10979*# Texas A&M Univ., College Station. Graduate Inst. of Statistics.
THE EFFECTS OF SERIES TRUNCATION ON ESTIMATES AND THE TRANSFORMATION OF ERRORS Semiannual Report, 1 Mar.–30 Aug. 1970
31 Aug. 1970 15 p refs
(Grant NGR-44-001-095)
(NASA-CR-111144) Avail: NTIS CSCL 12A

Considered is parametric estimation using censored data from a particular statistical distribution, the implementation of an advanced Monte Carlo technique, the computer implementation of the maximum likelihood procedure for estimating the parameters in a general mixed analysis of variance model, and a result for optimally choosing sample size and intentionally choosing to observe partial data vectors. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-10088# Swiss Inst. of Meteorology, Zurich.
METEOROLOGICAL BIBLIOGRAPHY: SWITZERLAND [BIBLIOGRAPHIE METEOROLOGIQUE SUISSE]
Jul. 1970 17 p refs In FRENCH
Avail: NTIS

A bibliography on meteorological techniques, services, and observations is presented for Switzerland. Transl. by E.H.W.

N71-10089*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPRETATION OF OBSERVATION DATA FROM METEOROLOGICAL SATELLITES
K. Ya. Kondrat'ev et al 1970 376 p refs Transl. into ENGLISH of the book "Prakticheskoe Ispol'zovanie Dannykh Meteorologicheskikh Sputnikov" Leningrad, Gidrometeorol. Izd., 1966 Sponsored by NASA and NSF
(NASA-TT-F-511; TT-68-50310) Copyright. Avail: NTIS CSCL 04B

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1. THE POTENTIALITIES OF SATELLITE-BORNE EQUIPMENT FOR METEOROLOGICAL RESEARCH p 5–55 refs (See N71-10090 01-20)

2. THE USE OF RADIATION DATA OBTAINED WITH METEOROLOGICAL SATELLITES p 56–136 refs (See N71-10091 01-20)

3. THE PROCESSING OF METEOROLOGICAL SATELLITE DATA p 137–190 refs (See N71-10092 01-20)

4. THE PRACTICAL USE OF TELEVISION AND INFRARED PICTURES OBTAINED FROM METEOROLOGICAL SATELLITES p 191–295 refs (See N71-10093 01-20)

N71-10090*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE POTENTIALITIES OF SATELLITE-BORNE EQUIPMENT FOR METEOROLOGICAL RESEARCH
In its Interpretation of Observation Data from Meteorol. Satellites 1970 p 5–55 refs (See N71-10089 01-20)
Copyright. Avail: NTIS CSCL 04B

Methods for determining the most important meteorological elements of weather prognosis by satellite-borne instruments include: (1) television; cloud observations; (2) measurements of earth radiation budget by temperature probes; (3) spectrometry for determining radiation field of the earth; (4) outgoing radiation measurements for vertical air-temperature distribution and atmospheric composition; (5) ground based radar for cloudiness and precipitation investigations; (6) laser and spectral measurements to determine the height of the upper cloud boundary; (7) transonde tracking by satellite systems to obtain data on the terrestrial wind field; and (8) energy distribution measurements in the ultraviolet solar spectrum to determine ozone content of the atmosphere. The creation of a weather satellite system also requires the proper selection of orbits and automatic processing of meteorological data. Outlined are the U.S. program for meteorological satellites and a global meteorological observation system that contains conventional ground-based observation, synchronous meteorological satellites, lunar stations, and manned orbiting space laboratories. G.G.

N71-10091*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE USE OF RADIATION DATA OBTAINED WITH METEOROLOGICAL SATELLITES
In its Interpretation of Observation Data from Meteorol. Satellites 1970 p 56–136 refs (See N71-10089 01-20)
Copyright. Avail: NTIS CSCL 04B

The present brief survey contains results of interpretation of radiation data obtained by meteorological satellites that may be used for immediate practical application. Presented are various problems connected with methods of measuring the outgoing radiation. For such problems, conversion of sensor data on outgoing radiation to physical values (e.g., fluxes of outgoing radiation) is extremely important. One of the basic problems of long-range weather forecasting is the necessity to take into account the energy budget of large-scale atmospheric processes. Author

N71-10092*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE PROCESSING OF METEOROLOGICAL SATELLITE DATA
In its Interpretation of Observation Data from Meteorol. Satellites 1970 p 137–190 refs (See N71-10089 01-20)
Copyright. Avail: NTIS CSCL 04B

Considered are the following four groups of problems, relating to the practical processing of satellite data: (1) geographical gridding (correlation) of pictures and the elimination of distorting factors; (2) geographical correlation and rectification of photographs obtained by the automatic picture transmission system; (3) processing of nephananalysis data; and (4) processing of data on outgoing radiation. Author

N71-10093*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE PRACTICAL USE OF TELEVISION AND INFRARED PICTURES OBTAINED FROM METEOROLOGICAL SATELLITES

In its Interpretation of Observation Data from Meteorol. Satellites 1970 p 191–295 refs (See N71-10089 01-20)

Copyright. Avail: NTIS CSCL 04B

Main stress is laid on cloud identification, analysis of extratropical cyclones, atmospheric fronts, ice and snow fields, and of mist and fog zones. Much attention is also paid to the tropical zone, particularly to tropical cyclones and to the use of meteorological satellite data in routine work. Cloudiness data obtained from satellite TV pictures have been most immediately useful in passing from the analysis of cloud fields and patterns to the analysis of other meteorological fields, e.g., wind circulation near the ground and at certain altitudes, study of jet streams, baric fields, etc. As is easily seen, satellite TV pictures are useful not only for cloud observations, but also for the study of many other meteorological phenomena. The possibilities afforded by satellite TV pictures are even wider when using IR data. However, the use of satellite-picture data becomes still more effective if we combine satellite data with other meteorological information. Author

N71-10118# France. Direction de la Meteorologie Nationale, Paris.

OBSERVATION AND MEASUREMENT OF GROUND VISIBILITY. AUTOMATIC CALCULATION OF THE VISUAL RANGE OF AIRPORT RUNWAYS [OBSERVATION ET MESURE DES VISIBILITES AU SOL. CALCUL AUTOMATIQUE DE LA PORTEE VISUELLE DE PISTE SUR LES AERODROMES]

C. Perrin de Brichambaut and A. Bettan Aug. 1970 57 p refs In FRENCH *Its* Monographie No. 76

Avail: NTIS

CONTENTS:

1. OBSERVATION AND MEASUREMENT OF GROUND VISIBILITY C. P. de Brichambaut p 1–29 (See N71-10119 01-29)

2. AUTOMATIC CALCULATION OF THE VISUAL RANGE OF AIRPORT RUNWAYS A. Bettan p 31–51 refs (See N71-10120 01-20)

N71-10119# France. Direction de la Meteorologie Nationale, Paris.

OBSERVATION AND MEASUREMENT OF GROUND VISIBILITY [OBSERVATION ET MESURE DES VISIBILITIES AU SOL]

C. Perrin de Brichambaut *In its* Observation and Meas. of Ground Visibility Aug. 1970 p 1–29 In FRENCH (See N70-10118 01-20)

Avail: NTIS

Definitions are given for night and day visibility. Measurements were made of the optical meteorological bearing and the runway visual range to determine the optical characteristics of the atmosphere. Measurements included transmission factors, extension of the mean coefficient in a column of air, and the diffusion of the luminary in a small volume of air. Calculation were made from the point of view of the pilot and an observer. Results of night and day meteorological visibility, and transmission factors are given in tables. Transl. by E.H.W.

N71-10120# France. Direction de la Meteorologie Nationale, Paris.

AUTOMATIC CALCULATION OF THE VISUAL RANGE OF AIRPORT RUNWAYS [CALCUL AUTOMATIQUE DE LA PORTEE VISUELLE DE PISTE SUR AERODROME]

A. Bettan *In its* Observation and Meas. of Ground Visibility Aug. 1970 p 31–51 refs In FRENCH (See N70-10118 01-20)

Avail: NTIS

An operational system to measure, compute, and supply runway visual range data automatically is discussed. Data are taken for luminance, atmospheric transmission and diffusion, and visibility range of the running track. The stability and performance of the system are also discussed. Transl. by E.H.W.

N71-10240*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ON THE RELATIONSHIP BETWEEN SMALL-SCALE WIND SHEARS AND WIND PROFILE POWER SPECTRA

George H. Fichtl 27 Oct. 1970 32 p refs

(NASA-TM-X-64562) Avail: NTIS CSCL 04B

Rawinsonde wind profile data provide accurate wind shear information for intervals Delta z > or = to 1 km. To specify wind shears for Delta z < 1 km for space vehicle design, detailed wind profile information like that provided by the FPS-16 radar/Jimsphere system or an extrapolation procedure is required. It is assumed that any realization from an ensemble of wind profiles can be represented in terms of a Fourier integral. This permits the calculation of the ensemble standard deviation and mean of the corresponding shear ensemble for any altitude and shear interval Delta z in terms of the power spectrum of the ensemble of wind profiles. To calculate how the mean and standard deviations depend on Delta z, it is assumed that (1) the wind profile power spectrum behaves like k to the minus 2.4 power at sufficiently large values of the vertical wave number k, (2) the vertical variation of the power spectrum can be neglected locally in the calculations of the ensemble mean and standard deviations of the wind shear, and (3) the probability distribution function of the standardized shear variate is invariant with Delta z. The results of these calculations show that the mean and standard deviations of the shear ensemble, as well as the shear for any percentile, asymptotically behave like (delta z) to the 0.7th power. This result is in excellent agreement with shear data from Cape Kennedy, Florida. Author

N71-10350*# Scientific Translation Service, Santa Barbara, Calif.

THE STATISTICAL STRUCTURE OF OUTGOING RADIATION FIELDS [O STATISTICHESKOY STRUKTURE POLEY UKHODYASHCHEY RADIATSII]

V. G. Boldyrev et al Washington NASA Nov. 1970 12 p Transl. into ENGLISH from Tr. Gidrometeorologicheskogo Nauchno-Issled. Tsentra SSSR (Leningrad), no. 20, 1968 p 51-59

Contract NASw-2035)

(NASA-TT-F-13368) Avail: NTIS CSCL 04B

The relationship between the statistical characteristics of outgoing radiation fields, measured by the "Cosmos-122" satellite, and cloud distribution is discussed. We introduce two-dimensional correlation functions of the radiation intensity in the 0.3 to 3.0 microns ranges, and of the radiation temperature in the 8 to 12 microns spectral interval, as well as the one-dimensional spectral density of the radiation temperature for individual directions. The aforenamed magnitudes were computed on the assumption that the outgoing radiation measurements are located at the nodes of some rectangular lattice of points. It is demonstrated that two dimensional correlation functions and the spectral density of outgoing radiation fields reflect in a certain manner the cloud distribution, and hence can be used as one of the quantitative representation methods of this distribution. Author

N71-10497# Weather Bureau, Silver Spring, Md. Systems Development Office.

LORAN-C WINDFINDING CAPABILITIES: WALLOPS

ISLAND EXPERIMENTS
D. T. Acheson Aug. 1970 36 p refs
(ESSA-TM-WBTM-EDL-11) Avail: NTIS

The accuracy of measuring winds aloft by tracking free rising balloons with Loran-C was investigated. The experiments established that, in regions of favorable reception, measurement errors for 1- and 2-minute averaged wind speeds are less than 0.5 knots. As part of the development of a next generation upper air sounding system, the results are directly applicable to the use of Loran-C in that system. They also allow Loran-C to be used as a standard to explore the accuracy of Omega as a complementary windfinding technique. Author

N71-10615# National Severe Storms Lab., Norman, Okla.
BEHAVIOR OF WINDS IN THE LOWEST 1500 FEET IN CENTRAL OKLAHOMA: JUNE 1966–MAY 1967
Kenneth C. Crawford and Horace R. Hudson Aug. 1970 68 p refs
(ESSA-TM-ERLTM-NSSL-48) Avail: NTIS

A one year data sample consisting of the mean wind speed and direction and the highest recorded gust during one 5-minute period per hour is submitted. Data are obtained from a television tower in northern Oklahoma City, Oklahoma, equipped with wind and temperature sensors at 6 levels ranging from 146 ft to 1458 ft above the base of the tower. Data are also obtained from a nearby tower 23 ft above ground level and 40 ft above the base of the television tower. The variability of wind speed and direction is investigated using transition matrices (probabilities for change with time) and wind persistence (number of consecutive observations the winds blow from a given sector). Wind shear speed is greatest in the lowest layer and least in the sixth layer. Speed shear is dominant over direction shear in the lower 3 layers and a combination of speed and direction shear occurs in the upper 3 layers. The speed shear decreases rapidly near sunrise, reaches a minimum in early afternoon, and increases rapidly near sunset. Shear is greater in all layers at night than during the day. Author

N71-10649# Weather Squadron (24th), Detachment 22, Keesler AFB, Miss.
TERMINAL FORECAST REFERENCE FILE Final Report
Jun. 1970 94 p
(AD-710617) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting Weather at Keesler AFB, MS. Included are location and topography, weather controls, climatic aids, and special synoptic studies. Author (TAB)

N71-10651# Nolit Publishing House, Belgrade (Yugoslavia).
DIVERGENCE, VERTICAL VELOCITY AND ENERGY CONVERSION IN THE WEST MEDITERRANEAN DURING CYCLONE DEVELOPMENT OF 24 OCTOBER 1964 [DINAMICKE I ENERGETSKE KARAKTERISTIKE RAZVOJA CIKLONA OD 24. OKTOBRA 1964. U ZAPADNOM REDOZEMLJU]
Duro Radinovic et al 1970 117 p refs Transl. into ENGLISH of Meteorol. Inst., Fac. of Sci., Belgrade Paper No. 7 Sponsored by ESSA and NSF
(TT-69-51019) Avail: NTIS

For a selected synoptic situation characterized by a rapid cyclone development in the whole troposphere over the west Mediterranean the field of divergence and the corresponding vertical velocities were computed by using the continuity equation for standard isobaric surfaces up to 150 mb. From the field of vertical velocity the rate of conversion between potential and kinetic energy is evaluated using the pressure coordinate system. Some terms of that conversion are evaluated by also making use of the sigma vertical coordinate. For the same region the net flux of kinetic energy across the horizontal and vertical boundaries and the dissipation of energy due to friction are also estimated, and the results are then compared with the observed change of kinetic energy inside the region. Author

N71-10707# Dayton Univ., Ohio. Research Inst.
A METHOD OF COMPUTING WINDS, DENSITY-TEMPERATURE, PRESSURE, AND THEIR ASSOCIATED ERRORS FROM THE HIGH ALTITUDE ROBIN SPHERE USING AN OPTIMUM FILTER Final Report, Jan. 1967–Dec. 1969
James K. Luers Jul. 1970 115 p refs
(Contract F19628-67-C-0102)
(AD-711405; AFCRL-70-0368) Avail: NTIS CSCL 4/2

Optimum reduction techniques have been determined and a computer program written to measure density, winds, temperature and pressure from the passive ROBIN Sphere in the 30-100 km region of atmosphere. The program extends the maximum altitude of the 1965 ROBIN Program from 70-100 km. Output from the computer program also includes the estimated noise errors in density, winds, temperature, and pressure, the frequency response of density and winds as function of altitude, and Cal-comp plots of the meteorological parameters. The smoothing techniques used in the program were determined so as to minimize the sum of the random and bias errors in density and winds. A separate smoothing function was determined for density and for wind calculations. The density smoothing function expands below 60 km in order to maintain a constant 2% noise error in density. All possible sources of error in the meteorological parameters are discussed. For the first time error equations have been derived for temperature and pressure errors. Error estimates are made for random errors, bias errors, and errors resulting from the initial estimate of temperature. Author (TAB)

N71-10720# National Severe Storms Lab., Norman, Okla.
SEVERE THUNDERSTORM RADAR ECHO MOTION AND RELATED WEATHER EVENTS HAZARDOUS TO AVIATION OPERATIONS
Peter A. Barclay and Kenneth E. Wilk Jun. 1970 68 p refs
(ESSA-TM-ERLTM-NSSL-46) Avail: NTIS

Objective techniques for identifying and tracking individual storms by radar are described, using digital weather radar data with space resolution of approximately 1 n.mi. The minimum time interval between observations required for deriving storm centroid velocity is 2 to 3 minutes. The optimum signal threshold for defining storm cores for tracking is 1000 to 10,000 mm(6)m(-3) for isolated storms and 100 to 1000 mm(6)m(-3) for squall lines. A technique is suggested for the extrapolation of arrival of a thunderstorm core into a control zone of an airport. The degree of confidence in the extrapolated path is measured in terms of timing and distance errors resulting from the variance in storm velocity. Analyses of the wind fields associated with several severe squall lines show narrow zones of high winds that veer sharply with increased speed and contain strong gusts that also increase with mean wind speed. Author

N71-10732# RAND Corp., Santa Monica, Calif.
A MODEL OF GLOBAL CLIMATE AND ECOLOGY
William R. Graham and Michael Warshaw Sep. 1970 21 p refs Presented at the 1970 Natl. Invitational Seminar on Advanced Simulation, 24–26 Sep. 1970; sponsored jointly by the Simulation Councils, Inc. and Univ. of Southern Calif.
(AD-711498; P-4454) Avail: NTIS CSCL 4/2

Considerable progress has been made in recent years in understanding the ecology and the effects of mans activities upon regions the size of lakes, estuaries, forests, and grasslands. As mans intrusions into these ecosystems have increased in recent decades, urgent and acute problems have arisen which demand the immediate application and extension of local ecosystem research. There is, in addition, a problem on a larger scale. This is the

problem of the long term, persistent effects of mans activities when viewed on a global scale. Will man, carrying his proliferation of works and bodies into the future, seriously (and possibly irreversibly) affect the global climate, his own food supply, and even the biological balance of the planet. The paper discusses the feasibility of answering, in a quantitative way, that question. Author (TAB)

N71-10795# Israel Program for Scientific Translations, Ltd., Jerusalem.

STRUCTURE OF FIELDS OF METEOROLOGICAL ELEMENTS IN A CUMULONIMBUS ZONE

S. M. Shmeter 1970 122 p refs Transl. into ENGLISH from Russian report Sponsored by ESSA and NSF *Its* Trans. of the Central Aerol. Obs. no. 88

(TT-70-50020) Copyright. Avail: NTIS

An experimental investigation into the magnitude and spatial distribution of perturbations in the wind and temperature field and of mesoscale and turbulent vertical currents near clouds and in cumulonimbus tops is presented. The evolution of cloud characteristics and perturbations in meteorological fields in a cloud region are described during the life period of the cumulonimbus cloud. The summary of measurements is preceded by a literature review and a description of experimental techniques. A kinematic model of cumulonimbus is presented, including all aspects of the cloud's interaction with the surrounding atmosphere. Detailed data are given on aircraft flights inside cumulonimbus clouds and in the surrounding atmosphere. Author

N71-10811# Environmental Science Services Administration, Washington, D.C.

THUNDERSTORMS

1968 5 p

(ESSA-DI-670004) Avail: SOD $0.15

The anatomy of thunderstorms is considered and thunderstorm safety rules are described. It is shown that thermal instability and convective overturning of atmospheric layers set up thunderstorms; continuous updraft drives produce cumulus formations, possible chimney effects, and finally a towering cumulonimbus system of moist air. As water vapor in the cloud is raised to saturation levels, the air is cooled sufficiently to liberate solid and liquid water particles, and precipitation and lightning begins. Lightning strokes represent the flow of current between the positive ground charge and the negative charge in the cloud. G.G.

N71-10843# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.

UNUSUAL EXTREMES AND DIURNAL CYCLES OF DESERT HEAT LOADS

Irving I. Gringorten and Norman Sissenwine Jun. 1970 21 p refs Environ. Res. Paper No. 323

(AD-711366; AFCRL-70-0332) Avail: NTIS CSCL 14/2

Diurnal cycles of high temperature during which equipment must operate, and long-term temperature extremes and cycles which equipment must withstand without irreversible damage, are provided for the revision of MIL-STD-210A, Climatic Extremes for Military Equipment. The high temperature during which the equipment should be operable was selected from a companion study. The still higher temperatures that the equipment must withstand on standby for periods of 2 to 25 years without irreversible damage are new. The areas studied for these extremes included Death Valley, Calif., and stations in French West Aftica. The operational upper 1-percent extreme in the hottest month in the worst location is 120F; the associated dirunal cycle has an amplitude of 29F. The withstanding upper 10-percent extreme is 128F for a 2-year planned life, increasing to 133F for a 25-year planned life. Author (TAB)

N71-10886# New York Univ., N.Y. Geophysical Sciences Lab.

CALCULATIONS OF MULTIPLE BACKSCATTERED RADIATION AND DEPOLARIZATION FROM WATER CLOUDS FOR A COLLIMATED PULSED LIDAR SYSTEM

Kuo-nan Liou Jun. 1970 87 p refs

(Contract DI-14-06-D-6440)

(PB-193435; GSL-TR-70-8) Avail: NTIS CSCL 04B

The cloud models chosen in generating the Mie phase functions in this study are 'modified gamma' distributions. The cloud models are compared to the observed droplet size distributions. The resulting values of the calculated phase functions are discussed in detail for different modal and cutoff radii. No significant change in the values of the phase function is found for the size distribution models when the cutoff radii are varied between 17 microns and 30 microns. The calculations are performed for secondary backscattered radiation in terms of wavelength, cloud height, beam width, and particle number density. Author (USGRDR)

N71-10894# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

CONTRIBUTIONS FROM THE CLOUD PHYSICS GROUP. STUDIES OF ARTIFICALLY SEEDED AND UNSEEDED WINTER STORMS OVER THE CASCADE MOUNTAINS (1969–1970)

Peter V. Hobbs, L. F. Radke, J. Loctelli, C. Robertson, R. Farber et al Jun. 1970 138 p refs

(Contract DI-14-06-D-5970)

(PB-193443) Avail: NTIS CSCL 04B

During the winter of 1969 to 1970 airborne and ground measurements were made in a number of storms over the Cascade Mountains of Washington State. The airborne measurements included cloud particle sampling, ice nucleus concentrations, liquid water content, turbulence, temperature, dewpoint, and radar observations. The aircraft was also equipped with silver iodide pyrotechnic units for seeding the clouds with artificial ice nuclei. At a network of ground stations in the Cascade Mountains measurements and observations were made of ice nucleus concentrations, the concentrations of freezing nuclei and of silver in the snowfall, the rate and nature of the snowfall, and regular synoptic observations. In addition, a radar was located in the mountains and radiosondes were launched from Olympia, Washington. Author (USGRDR)

N71-10895# Florida Univ., Gainesville.

MIXING HEIGHT DETERMINATIONS BY MEANS OF AN INSTRUMENTED AIRCRAFT

R. O. McCaldin and R. S. Sholtes Jun. 1970 31 p refs

(Contract PHS-CPA-22-69-76)

(PB-193419; APTD-0572) Avail: NTIS CSCL 04A

Ambient air pollutant concentrations are a function of the rate of pollutant emission, wind speed and direction, and the altitude to which pollutants can mix. Air pollution models based at least in part on relationships such as these are being used by control agencies to develop optimum control strategies. Information pertaining to mixing heights and wind speeds are integrated with other meteorological information to forcast air pollution potential for the contigious United States. The project was performed in order to evaluate mixing height estimates made by the technique designated as the Holzworth method. Author (USGRDR)

N71-10906# Naval Weather Service, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 8: AREA 24–POINT MUGU, AREA 25–SAN FRANCISCO, AREA 26–POINT ARENA

May 1970 486 p

(AD-710771) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface Observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas includes Point Mugu, Point Arena and San Francisco, California. Author (TAB)

N71-10907# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 6: AREA 17—NEW ORLEANS, AREA 18—GALVESTON, AREA 19—CORPUS CHRISTI
May 1970 486 p
(AD-710770) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas include New Orleans, Louisiana, Galveston, Texas, and Corpus Christi, Texas.
Author (TAB)

N71-10908# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: NORTH AMERICAN COASTAL MARINE AREAS. VOLUME 10: AREA 30—ASTORIA, AREA 31—SEATTLE
May 1970 325 p
(AD-710829) Avail: NTIS CSCL 4/2

The data contained in these tables were obtained from tape data Family II (TDF-II), Marine Surface observations. TDF-II was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The areas include Astoria, Oregon and Seattle, Washington.
TAB

N71-10923# Israel Program for Scientific Translations, Ltd., Jerusalem.
ATMOSPHERIC SCAVENGING OF RADIOISOTOPES
B. Styra et al, ed. 1970 256 p refs Transl. into ENGLISH of the book "Issledovanie Protesessov Samoochischeniya Atmosfery Ot Radioaktivnykh Izotopov" Mintis, 1968 p 1—250 Presented at the Conf. in Palanga, Lithuania, 7-9 Jun. 1968 Sponsored by Dept. of Com. and NSF
(TT69-55099) Copyright. Avail: NTIS

Conference papers are presented on nuclear meteorology, particularly related to atmospheric contamination from nuclear tests. The specific areas are meteorological aspects of atmospheric scavenging of radioactive dust, rate of deposition of radioactive substances from the atmosphere, variation and characterization of radioactive fallout, precipitation washout of radioactive isotopes, radioactivity concentration in surface air during atmospheric scavenging, and washout of isotopes injected into a cloud.
N.E.N.

N71-10948# Weather Squadron (24th), Detachment 11, Reese AFB, Tex.
TERMINAL FORECAST REFERENCE FILE, REESE AFB, TEXAS Final Report
Jul. 1970 47 p refs
(AD-711390) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the weather at Reese AFB, TX. Included are location and topography, weather controls, climatic aids, and special synoptic studies.
Author (TAB)

N71-10949# Weather Squadron (24th), Detachment 15, Vance AFB, Okla.
TERMINAL FORECAST REFERENCE FILE, VANCE AFB, OKLAHOMA Final Report
15 Jul. 1970 83 p refs
(AD-711381) Avail: NTIS CSCL 4/2

The reference file discusses factors affecting the weather at Vance AFB, Ok. Included are location and topography, weather controls, climatic aids, and special synoptic study.
Author (TAB)

N71-10980# Air Force Cambridge Research Labs., Bedford, Mass. Aeronomy Lab.
INTERNAL GRAVITY WAVES OBSERVED IN MESOSPHERIC TEMPERATURE MEASUREMENTS
Samuel P. Zimmerman and Andrew C. Faire 7 Jul. 1970 19 p refs *Its* Phys. Sci. Res. Paper No. 421
(AD-711640; AFCRL-70-0383) Avail: NTIS CSCL 4/2

Temperature height profiles determined from falling sphere and Arcasonde measurements, made at White Sands, New Mexico from 23 to 25 January 1967, exhibit unusually large variability in the vicinity of the mesopause. Spatial and temporal analysis of the data exhibit a wave-like structure with vertical half wavelengths of the order of 3 and 30 km and a characteristic period of approximately 12 hours for the longer wavelength. Comparison with meteorological data below 60 km and application of appropriate theory leads to the tentative suggestion that the observed temperature variations were due to internal gravity waves. The analysis also infers that the source of these waves was a large scale, low altitude (approximately 200 mb) synoptic disturbance. This work has been performed in support of re-entry studies for Air Force space vehicles and investigations for improving DOD missile impact prediction capability.
Author (TAB)

N71-10988*# Scientific Translation Service, Santa Barbara, Calif.
MACHINE ANALYSIS OF INFRARED CLOUD IMAGES OBTAINED BY THE COSMOS-122 SATELLITE [MASHINNYY ANALIZ INFRAKRASNYKH IZOBRAZHENIY OBLACHNOSTI POLUCHENNYKH SO SPUTNIKA KOSMOS-122]
L. G. Mexina et al Washington NASA Nov. 1970 15 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchno-Issledovatel' Skogo Tsentra SSR (USSR), no. 20, 1968 p 89—98
(Contract NASw-2035)
(NASA-TT-F-13369) Avail: NTIS CSCL 04B

The selection of decoding characteristics used in the machine identification of clouds, and a block diagram for the computation of these characteristics as applicable to the IR photographs taken by the Cosmos-122 satellite are briefly described. Part of the automated program includes a decision block regarding the type of clouds shown on the analyzed IR photographs. Decision is accomplished by using previously computed magnitudes of the decoding characteristics. The program, according to the instructions of the operator, who is familiar with the true nature of the clouds on the analyzed photograph, plots a special sequence of numbers, i.e., the weights of the decoding characteristics. In accordance with these weights, the computer, operating in the recognition mode (which is the working mode) decides on the nature of the clouds, using other IR images, that are not known to the operator.
Author

N71-10991*# National Aeronautics and Space Administration, Washington, D.C.
INFRARED PICTURES OF CLOUD COVER TAKEN BY THE COSMOS-122 SATELLITE [INFRAKRASNYYE IZOBRAZHENIYA OBLACHNOSTI SO SPUTNIKA KOSMOS-122]
I. P. Vetlov 1970 17 p refs Transl. into ENGLISH from Interpretatsiya i Ispol' Zovaniye Sputnikovykh Dannykh, GMTs (USSR), no. 20, 1968 p 11—21
(NASA-TT-F-13362) Avail: NTIS CSCL 04B

A brief description and operating principles are given for the infrared apparatus mounted aboard the Cosmos-122 satellite. The possibilities of recognizing clouds by their infrared pictures are considered and the characteristic features of the structure and brightness of the images of various types of subjacent surfaces and cloud systems are described. The brightness and morphological features of the infrared pictures of cloud cover in zones of atmospheric fronts and cyclones are described as a function of the state of development of these disturbances. Characteristic geometric and brightness features associated with pictures of cloud cover

related to tropical disturbances are presented, the inter-tropical zone of convection and typhoons, and infrared pictures are provided for the zone of inter-tropical convergence and typhoons. Author

N71-10995*# Scientific Translation Service, Santa Barbara, Calif.
ANALYSIS OF THE WIND-FIELD PATTERN IN CYCLONES, USING TELEVISION PICTURES OF CLOUD COVER TAKEN BY THE 'COSMOS-122' SATELLITE [ANALIZ POLYA VOZDUSHNYKH TECHENII V TSIKLONAKH PO TELEVIZIONNYM IZOBRAZHENIYAM OBLACHNOSTI SO SPUTNIKA 'KOSMOS-122']
A. I. Burtsev et al Washington NASA Nov. 1970 14 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 20, 1968 p 4–10
(Contract NASw-2035)
(NASA-TT-F-13361) Avail: NTIS CSCL 04B

The structural features of cloud fields in two cyclones with fields of vertical air velocities and streamlines are compared. It was shown that the isolines of zero vertical velocities in the lower half of the troposphere generally follow the cloud spirals and the frontal cloud bands, consisting mainly of stratiform clouds. The development of a field of vertical movements in the cyclone is traced. Gradually descending movements from the rear of the cyclone are distributed behind a cold front into the southern and central parts of the cyclone. The development of the cloud spiral also follows the development of the vertical velocity field. It is shown that the cumuliform clouds in the frictional layer are arranged along the streamlines converging on the center of the cyclone. Above the frictional layer, there arises a single spiral of stratiform clouds, all circling the center of the cyclone. It is pointed out that the zone of partly cloudy weather between two cyclones coincides with the lines of convergence of the streamlines, clearly visible at the 500 mb level. Author

N71-10998# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
PRECIPITATION FROM COOLING TOWERS IN COLD CLIMATES
Thomas J. Overcamp and David P. Hoult May 1970 35 p refs *Its* Publ. No. 70-7
(Grant NIH-1-ROI-AP-0067-02)
(PB-192626) Avail: NTIS CSCL 04B

A model is proposed for determining the conditions under which precipitation can occur from a natural draft cooling tower. Because the time scale for forming rain drops is large compared to the average residence time of droplets in the plume, there is no precipitation unless the plume mixes with the aerodynamic wake of the tower and is brought to the ground. When this occurs, the small fog droplets in the plume will diffuse to the ground causing a light precipitation. In cold climates, this could freeze on the ground and be hazardous for travel. A simple theory gives the heat transfer and the flux of water vapor emitted by the cooling tower. Equilibrium thermodynamics of mixing processes are used to calculate how much water vapor condenses as the plume is diluted with the sorrounding air. Author (USGRDR)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-10110*# Air Force Flight Test Center, Edwards AFB, Calif.
IFR EXPERIENCE WITH UNPOWERED, LOW-LIFT-DRAG-RATIO LANDING APPROACHES
Peter C. Hoag and B. Lyle Schofield *In* NASA. Flight Res. Center Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 109–125 refs (See N71-10101 01-31)
Avail: NTIS CSCL 17G

The results of IFR flight studies are discussed and two terminal area guidance schemes are presented specifically designed for terminal area energy management and guidance of unpowered, low L/D ratio vehicles. The studies involved the F-111A, F-104, and NB-52B aircraft. The approaches considered include ILS, IFR, and ground controlled. It was found that IFR approaches made in the NB-52B airplane were no more difficult to fly than similar approaches with the smaller aircraft. In addition, ILS approaches were found easier to perform than ground controlled approaches under the same conditions. D.L.G.

N71-10163# Royal Radar Establishment, Malvern (England).
A TRAFFIC SAMPLE FOR AIR TRAFFIC CONTROL MODEL EVALUATION
R. W. Gregory *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p (See N71-10126 01-34)
Copyright. Avail: NTIS

Computer models are becoming increasingly important as a means of testing new ATC techniques. This traffic sample was generated as an input to such models; for the traffic situation in the London terminal area during the peak summer periods of the 1980s. The sample relates only to movements at Heathrow, Gatwick, and a third London Airport. It takes no account of minor airport traffic, but it does include traffic overflying London. It is based on the following assumptions: (1) All three airports are omni-directional. (2) Heathrow and the third London Airport each have a maximum sustainable movement rate of 70 per hour, while Gatwick's maximum sustainable rate is 45 per hour. (3) All three airports are subject to noise restrictions and, as a result, these rates can only be maintained between the hours 0700 to 2300. (4) SSTs operating in the London area have a performance similar to subsonic jets. Author

N71-10164# Royal Radar Establishment, Malvern (England).
A PROPOSAL FOR PRIMARY RADAR AUTOMATIC TRACKING IN TERMINAL AREAS
T. Buckley *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

With the ever-increasing density of civil air traffic in terminal areas such as that of London, there is a case to be made, on grounds of both the safety and capacity of the air traffic control system, for a three-dimensional radar system. Such a system must be capable of automatically and accurately tracking all the aircraft in a terminal area. One proposal for such a system is outlined and the more obvious advantages are highlighted. Author

N71-10259*# Jet Propulsion Lab., Calif. Inst. of Tech.
GUIDANCE AND CONTROL ANALYSIS AND INTEGRATION: GUIDANCE AND CONTROL DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 72–73 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 17G

An experiment was conducted to obtain measurements from onboard optical instruments which can be used for estimating the Mariner trajectory with respect to Mars, to develop software for processing the measurements and for estimating the spacecraft trajectory in near-real time, to make available to mission operations an estimate of the spacecraft trajectory based on a combination of radio and available optical measurements for optional use in encounter operations, and to make post-encounter comparison of the accuracy of the estimated spacecraft trajectory based on the optical and radio data. The results are applied to the Mariner Mars 1969 approach guidance system. R.B.

N71-10260*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT CONTROL: GUIDANCE AND CONTROL DIVISION
In its Space Programs Summary, 37-64, Vol. 3 31 Aug. 1970 p 74–78 (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 17G

Research progress is reported on a capacitive coupling technique to deliver digital commands to an attitude control single axis simulator, solar electric propulsion system technology, and a digital sun sensor for thermoelectric outer planet spacecraft. R.B.

N71-10342*# Techtran Corp., Glen Burnie, Md.
SOME QUESTIONS OF DESIGNING SPACECRAFT WITH THREE-AXIS ORIENTATION
I. M. Lisovich et al Washington NASA Nov. 1970 12 p Transl. into ENGLISH from the Russian Presented at the 21st Intern. Astron. Congr. Constance, West Ger., 4-10 Oct. 1970
(Contract NASw-2037)
(NASA-TT-F-13378) Avail: NTIS CSCL 17G

The necessary relationships between the solar batteries aboard a spacecraft, which must always be directed toward the sun, and the antenna providing communications with the earth, which must always point toward the latter, are described, together with the correcting motors and astronavigational aids required to achieve correct three-axis orientation. Author

N71-10626*# Avco Corp., Wilmington, Mass. Systems Div.
THE STUDY OF THE ATTITUDE CONTROL OF SMALL SATELLITES AND RELATED SUBSYSTEMS. VOLUME 1: SUMMARY Final Report
Stanley J. Brzeski 4 Sep. 1970 85 p refs
(Contract NAS1-10014)
(NASA-CR-111791; AVSD-0555-70-RR-Vol-1) Avail: NTIS CSCL 17G

Engineering studies and analyses were conducted on a satellite concept capable of quick response to the implementation of a single, or at most dual, experiment aboard a relatively simple and cost effective flight spacecraft system. In the implementation of the satellite concept, primary emphasis was focused on: (1) attitude control subsystem concepts and component hardware definition; (2) data handling subsystem concepts and component hardware definition; and (3) definition of a typical spacecraft system configuration to which the attitude control and data handling subsystems concepts can be applied. In order that all major aspects of this typical spacecraft system could be defined, secondary support studies were conducted to define related subsystems, such as, power, communications, and structure. A nominal amount of program planning was also conducted to establish a management framework to be used as a baseline for cost and availability trade-off comparisons of the major hardware elements in the attitude control and data handling subsystems. Author

N71-10627*# Avco Corp., Wilmington, Mass. Systems Div.
THE STUDY OF THE ATTITUDE CONTROL OF SMALL SATELLITES AND RELATED SUBSYSTEMS. VOLUME 2: SYSTEM AND SUBSYSTEM TECHNICAL RELEASES Final Report
Stanley J. Brzeski 4 Sep. 1970 345 p refs
(Contract NAS1-10014)
(NASA-CR-111792; AVSD-0555-70-RR-Vol-2) Avail: NTIS CSCL 17G

As a result of the engineering studies and analyses, a small satellite system concept was established. This concept will provide a quick response capability for flight test and evaluation of single, or at most dual, earth pointing experiments dedicated to applications, science, and technology disciplines. The following is discussed: (1) an identification and description of the mission elements, element interfaces, mission profile, mission sequence, and mission constraints, and (2) an identification and functional description of the small satellite system and its constituent equipments, subsystems, and assemblies including preliminary design data sheets for selected assemblies, subassemblies, and components. Author

N71-10678* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUN TRACKER WITH ROTATABLE PLANE-PARALLEL PLATE AND TWO PHOTOCELLS Patent
Frank A. Volpe and Benjamin G. Zimmerman, inventors (to NASA) Issued 28 Mar. 1967 (Filed 20 Dec. 1963) 9 p Cl. 250-203
(NASA-Case-XGS-01159; US-Patent-3,311,748; US-Patent-Appl-SN-332313) Avail: US Patent Office CSCL 17G

An optical-electronic system for determining the angle of incidence of solar illumination relative to a preestablished optical axis is described. The system comprises a light-responsive detector, a light-refracting optical slab, and a means for rotating the slab. The system provides highly accurate measurements with few moving parts, which are readily available state-of-the-art components. E.C.

N71-10737*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary Report, 1 May – 31 Jul. 1970
Herbert G. Weiss 15 Aug. 1970 18 p refs
(Contract AF 19(628)-5167)
(AD-711662; ESD-TR-70-235) Avail: NTIS CSCL 17/7

Efforts were made to evaluate quantitatively the capabilities and limitations of the systems, procedures, and instrumentation utilized for ATC. A new activity is directed toward defining and evaluating the impact that a data-linked cockpit display of Automated Radar Terminal System (ARTS) information could have upon terminal area capacity. Also under study is the application of a laser beam alerting system at Logan International Airport to increase the usefulness of Runway 4R. Author (TAB)

N71-10771* Hughes Aircraft Co., Culver City, Calif.
CANOPUS DETECTOR INCLUDING AUTOMOTIVE GAIN CONTROL OF PHOTOMULTIPLIER TUBE Patent
Daryl D. Errett and Eugene W. Peterson, inventors (to NASA) Issued 2 May 1967 (Filed 30 Jun. 1965) 6 p Cl. 250-203
Sponsored by NASA
(NASA-Case-XNP-03914; US-Patent-3,317,731; US-Patent-Appl-SN-468647) Avail: US Patent Office CSCL 17G

A star sensor is described capable of distinguishing the star Canopus from other stars for use in controlling the attitude of spacecraft. This is achieved by using a photomultiplier in which the output is a function of the light received from the sun. The light from the sun is used as a reference for measuring light from an unidentified star, and to control the operation or gain of the photomultiplier output when Canopus is in the field of view. Once Canopus is sensed the attitude of the vehicle is controlled by maintaining the light from Canopus at a predetermined point in the field of view of the sensor. F.O.S.

N71-10880*# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SNOW AND ICE OUTAGES-COMLO FACILITIES. TASK NO. 1: SOLID-STATE RADIO BEACON Final Report, Jun. 1969 – Nov. 1970
Jack A. Muller and Thomas H. Brousaard Nov. 1970 35 p
(FAA-RD-70-38; FAA-NA-70-36) Avail: NTIS

The test and evaluation of a low power solid-state radio beacon, are reported. It was concluded that, with some minor changes, such as an aluminum housing, lightning protection, and relocation of the antenna feed insulator, the system provides a satisfactory off-the-shelf item that is readily available as a temporary replacement to ensure continuity of compass locator (COMLO) service where outages occur due to snow and ice conditions. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-10271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEUTRON FLUX MEASUREMENTS IN A THREE-CAPSULE D2O TANK IN THE NASA PLUM BROOK MOCK-UP REACTOR
Klaus H. Gumto Oct. 1970 26 p refs
(NASA-TM-X-52910) Avail: NTIS CSCL 18K

Previous experiments with a capsule surrounded by D2O instead of H2O showed that the thermal neutron flux increased ten times in the regions of the HT-2 test hole away from the core. Experiments with a D2O tank containing three identical capsules were conducted. Compared to a single capsule in H2O, the sum of the flux in all three capsules was three times higher, the flux in the capsule nearest the core was two times as high, and the flux in each of the other two capsules was one half as high. Gamma heating was also measured. Author

N71-10331# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Apr.–May 1970
14 Jul. 1970 253 p refs
(Contract W-31-109-ENG-36)
(ANL-7688) Avail: NTIS

Highlights of project activities for April and May 1970 are summarized. LMFBR physics development and component development are reviewed. Operations and analysis of ZPR-3, ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, fuel fabrication, and operations are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, and LMFBR safety studies are reported. NSA

N71-10332# Argonne National Lab., Ill.
MATERIALS-COOLANT INTERACTIONS IN EBR-2
W. E. Ruther, T. D. Claar, S. Greenberg, and R. V. Strain Mar. 1970 47 p refs
(Contract W-31-109-ENG-38)
(ANL-7670) Avail: NTIS

Of the many materials deliberately exposed to the EBR-2 sodium coolant, only copper, beryllium copper, and tantalum experienced an undesirable direct reaction. Failures of thin sections of normally resistant metals (Types 304, 347, and 420 stainless steels and Inconel) were related to the presence of a contaminant (carbonaceous material or oxide) on the surface before insertion into the reactor sodium. Components removed from the reactor after long exposures showed only minor dissolution attack. The attack was greater with increasing temperature; however, radiation did not cause a detectable increase in the attack. Carbon transport among steels of differing carbon activity was inconsequential. Quantitative corrosion evaluations of vanadium alloys, stainless steels, nickel, and nickel-base alloys in the reactor coolant showed rapid corrosive attack only for unalloyed vanadium. Author (NSA)

N71-10335# California Univ., La Jolla.
VALIDITY OF THE STRUTINSKY SHELL CORRECTION THEORY
Wing-Fai Lin Apr. 1970 27 p refs
(Contract AT(11-1)-GEN-10)
(UCSD-10-P-11-104) Avail: NTIS

Realistic shell model potentials are used to test Strutinsky's method. It is found that the results are strongly dependent on the shell smearing parameter as well as the order of the curvature correction for smearing. No unambiguous values can be obtained for the shell correction, even with the effect of the continuum properly included. As a result, the Strutinsky theory should be regarded only as a recipe to be used in combination with Nilsson potentials. Author

N71-10373*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ANALYTICAL STUDIES OF IN-REACTOR TESTS OF A NUCLEAR LIGHT BULB UNIT CELL
Thomas S. Latham and Harold E. Bauer Sep. 1970 86 p refs
(Contract SNPC-70)
(NASA-CR-111098; J-910900-6) Avail: NTIS CSCL 21F

Analytical studies were conducted to determine the performance and design characteristics of a small model of a nuclear light bulb unit cell suitable for testing in a nuclear reactor. Three nuclear test reactors were considered: Pewee and the nuclear furnace, which are solid-core nuclear rocket fuel element test reactors, and the high flux isotope reactor. Demonstration tests with these thermal neutron flux environments created thermal radiation fluxes corresponding to black-body radiating temperatures of 12,500 to 14,600 R for models having reflecting walls and operating pressures of 500 atm. Preliminary design analyses of the test region pressure vessel, reflective liner, fuel handling system, and instrumentation were performed. Three types of tests of increasing complexity were considered: (1) a demonstration that nuclear fuel can be contained fluid dynamically while fissioning in a gaseous cloud; (2) a demonstration that internally cooled transparent walls are capable of withstanding both the nuclear radiation and thermal environments anticipated for a nuclear light bulb engine; and (3) a demonstration that seeded propellant can be heated to exhaust temperatures in excess of those presently attained in the solid-core nuclear rocket. Author

N71-10379*# United Aircraft Corp., East Hartford, Conn. Research Labs.
DEVELOPMENT AND TESTS OF SMALL FUSED SILICA MODELS OF TRANSPARENT WALLS FOR THE NUCLEAR LIGHT BULB ENGINE
Paul G. Vogt Sep. 1970 96 p refs
(Contract SNPC-70)
(NASA-CR-111100; J-910900-3) Avail: NTIS CSCL 21F

Fabrication techniques were developed for constructing models using thin-walled fused silica tubing, model configurations which provide satisfactory vortex flow patterns were derived, and the models were tested in a thermal environment similar to that in the engine. The transparent wall in the engine surrounds the fuel region and separates it from the annular propellant duct. A vortex, driven by a transparent buffer gas, is employed to isolate the fuel from the wall. The wall is internally cooled an has provision for circumferential injection of buffer gas to drive the vortex. Optical transmission characteristics of arrays of coolant tubes were measured, and procedures for predicting heat transfer rates and stresses in the tubes were developed. Author

N71-10403# Atomic Power Development Associates, Inc., Detroit, Mich.
PRELIMINARY STUDY OF FEASIBILITY OF ACOUSTIC DETECTION OF SMALL SODIUM-WATER REACTIONS IN LMFBR STREAM GENERATORS
S. Berkhoudarian and C. C. Scott May 1970 79 p refs
(Contract AT(11-1)-865)
(APDA-256) Avail: NTIS

An evaluation of acoustic techniques for the detection of sound resulting from water leaks into liquid Na is conducted.

Acoustic spectra over the range of 100 Hz to 80 kHz are detected. A leak as small as 0.00008 lb/sec is detected by the acoustic instrumentation. Since this is the smallest leak rate used in the tests, it is not to be interpreted as the smallest leak rate that might be detected by acoustic methods. Detection time is found to be essentially instantaneous. Author (NSA)

N71-10404*# United Aircraft Corp., East Hartford, Conn. Research Labs.

ANALYTICAL STUDIES OF START-UP AND DYNAMIC RESPONSE CHARACTERISTICS OF THE NUCLEAR LIGHT BULB ENGINE

Harold E. Bauer, Richard J. Rodgers, and Thomas S. Latham Sep. 1970 121 p refs

(Contract SNPC-70)

(NASA-CR-111097; J-910900-5) Avail: NTIS CSCL 21F

Analytical studies were conducted to evaluate systems for control of the reference nuclear light bulb engine during start-up and at nominal full-power operating conditions. Analytical models of the control systems were incorporated in the digital computer simulation program developed previously to determine operating conditions of the reference engine during start-up and the transient response of the engine to various perturbations at the nominal full-power operating level. Additional analyses were conducted to determine the effects of off-design flow fluctuations and fabrication tolerances on the operating conditions of the reference engine, to compare critical mass calculations with results of experiments on a seven-module cavity reactor to determine the design parameters such as radiator materials and operating temperatures and pressures for a space radiator to reject a portion of the moderator heat load, and to investigate the design characteristics and performance of an alternate nuclear light bulb engine configuration employing unit cells of smaller diameter than those envisioned for the reference engine. Author

N71-10405*# United Aircraft Corp., East Hartford, Conn. Research Labs.

RESULTS OF EXPERIMENTS TO SIMULATE RADIANT HEATING OF PROPELLANT IN A NUCLEAR LIGHT BULB ENGINE USING A D-C ARC RADIANT ENERGY SOURCE

John F. Klein and Ward C. Roman Sep. 1970 102 p refs

(Contract SNPC-70)

(NASA-CR-111099; J-910900-1) Avail: NTIS CSCL 21F

The primary objective was to obtain high exit temperatures in the simulated propellant stream due to the absorption of large percentages of the incident thermal radiation. A high-power dc arc was used as the radiant energy source and argon seeded with carbon particles was used to simulate the propellant. Unseeded buffer layers were used to prevent coating of the transparent duct walls. Methods were developed for introducing micron-sized carbon seeds into the central region of a three-stream flow in an annular duct to simulate the propellant stream. Supporting research was also conducted to increase the mass attenuation coefficient of the seeded stream, to determine the optical properties of particle clouds, to develop seeded stream and buffer layer injection geometries that minimize seed coating of the duct walls, and to develop high-temperature measurement techniques for use with particle-laden streams. Author

N71-10408# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

REACTOR CHEMISTRY DIVISION Annual Progress Report, Period Ending 31 May 1970

Jul. 1970 144 p refs

(Contract W-7405-eng-26)

(ORNL-4586) Avail: NTIS

Coated fuel particles, diffusion of actinides and fission products, coating failures, radiation effects, thermal diffusivity, fission product monitoring, and rotational collisional numbers of nitrogen, oxygen, carbon monoxide, and carbon dioxide were studies. Investigations on neutron irradiation of carbides and alumina ceramics, gamma irradiated polymers, radioinduced reaction of hydrocarbons, radiation resistant insulators, and Plowshare activities are reported. Research progress reviews are also included on molten salt chemistry and nuclear reactors, aqueous systems, and nuclear safety. J.A.M.

N71-10413*# United Aircraft Corp., East Hartford, Conn. Research Labs.

EXPERIMENTAL INVESTIGATIONS OF SIMULATED-FUEL CONTAINMENT IN RF HEATED AND UNHEATED TWO-COMPONENT VORTEXES

Jerome F. Jaminet Sep. 1970 112 p refs

(Contract SNPC-70)

(NASA-CR-111101; J-910900-2) Avail: NTIS CSCL 21F

Experiments were conducted to determine the containment characteristics of radial-inflow vortexes for application to the nuclear light bulb engine. In these investigations, the amount of simulated fuel contained in two-component vortexes was measured for both heated and unheated (isothermal) vortex flows. In the vortex flows with heat addition, power was added to the flow by r-f induction heating of the gas within 1.28 in. dia by 2.6 or 3.5 in. long chambers. The simulated buffer gas, argon, was injected in a tangential (circumferential) direction either from the end walls or from the peripheral wall. The flow rate, plasma diameter, and power addition were such as to provide radial gradients of temperature of approximately 70,000 deg R/in. near the outer edge of the plasma. Xenon was employed as the simulated fuel and was injected into the vortex at several different locations. Spectroscopic techniques were used to determine the temperature distributions and the simulated-fuel partial pressures within the plasma. Author

N71-10419# Los Alamos Scientific Lab., N.Mex.

HYDRAULIC EFFECTS IN CIRCULATING FUEL REACTORS

Felix T. Adler Jan. 1970 31 p refs

(Contract W-7405-eng-36)

(LA-4294) Avail: NTIS

The well-known results for the boundary layer flow in a pipe are reviewed with the aim of ascertaining the effects of the radial velocity distribution on the fuel exposure in a circulating fuel reactor. The laminar sublayer and the turbulent-laminar transition layer are of particular relevance for the fuel exposure because of the increased residence time of the fuel solution in these regions during core passage. The semiempirical approaches for the velocity distributions in these regions are reviewed in detail and are compared with experimental data. The radial distribution of energy deposition in aqueous solutions of U-235 corresponding to those of interest for the Kinetic Intense Neutron Generator (KING) reactor and possible full-scale devices are considered and compared with existing data on the limits for safe exposure not leading to fuel decomposition. Although exposures in the KING dynamic experiments appear to be acceptable, full-scale devices may have excessive energy deposition rates in the boundary region. Conjectures are discussed as to methods to avoid any excess local energy deposition in full-scale devices. Author (NSA)

N71-10420# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PNL-17: EBR-2 INSTRUMENTED SUBASSEMBLY TEST Interim Report

M. K. Millhollen and A. M. Sutey Jun. 1970 41 p refs

(Contract AT(45-1)-1830)

(BNWL-1424) Avail: NTIS

PNL-17 is a 37-pin, instrumented subassembly being irradiated in EBR-2 with thermocouples substituted for wire wrap on several of the pins. Hot junctions are so arranged that temperature readings are taken at both 1.5 and 6.0 in. above the bottom of the fuel column within selected coolant subchannels. The maximum calculated

linear pin power generation is 9.20 kW ft; sodium coolant inlet temperature is 700 F, and coolant flow through the subassembly is 53.3 gpm. Subchannel coolant temperature readings at 20 MW and 50 MW reactor power levels early in the life of the subassembly have been corrected for thermocouple calibration and compared with values calculated by the COBRA 2 A program. Correlation has been extremely good in most cases. The comparison of measured and calculated temperatures indicates that calculational methods being used to predict coolant channel performance of fuel test assemblies in EBR-2 are satisfactory. Author (NSA)

N71-10431*# United Aircraft Corp., East Hartford, Conn. Research Labs.

ANALYTICAL STUDY OF THE SPECTRAL RADIANT FLUX EMITTED FROM THE FUEL REGION OF A NUCLEAR LIGHT BULB ENGINE

N. L. Krascella Sep. 1970 56 p refs

(Contract SNPC-70)

(NASA-CR-111102; J-910904-1) Avail: NTIS CSCL 21F

A theoretical investigation was conducted to determine the spectral distribution of radiative flux emitted from the fuel region of a nuclear light bulb engine and, hence, the spectral radiative flux incident upon the transparent containment walls or upon the reflective end walls of such an engine. The analysis was performed for a specified engine configuration, for a specified nuclear fuel partial pressure distribution and for a total of 47 wave numbers. A total of six cases were calculated to investigate the effect on the spectral radiation flux of changes in total radiated flux, seed gas partial pressure, and end-wall reflectivity. The total radiated flux was changed from a reference value of 24,300 to 48,600 Btu/sq ft-sec. The effect of seed gases was examined by the addition of a mixture of 5 atm each of oxygen and nitric oxide. Wall reflectivity was examined by employing the spectral reflectivity of aluminum and silver in place of a zero-reflectivity wall employed in the reference case. Author

N71-10455*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A FREEZE, MELT VALVE AND DISPENSING SYSTEM FOR CESIUM

James F. Morris Washington Nov. 1970 6 p refs

(NASA-TM-X-2126; E-5884) Avail: NTIS CSCL 18A

Nuclear thermionic diodes for space electric power require cesium purity control, which vacuum packaging allows. However, dispensing small quantities of such a reactive element into prebaked evacuated capsules poses unique valving problems. One answer is the freeze, melt valve, an orifice that closes or opens as the cesium solidifies or liquifies locally. A single resistant metal contacts the corrosive liquid in a very simple, extremely compact, reliable flow regulator. These characteristics make it a good valve for reactive liquids in general. The design and operation of a freeze, melt valve used in vacuum encapsulating cesium for thermionic diodes is described. Author

N71-10501*# United Aircraft Corp., East Hartford, Conn. Research Labs.

EXPERIMENTAL INVESTIGATION OF A HIGH-INTENSITY RF RADIANT ENERGY SOURCE TO SIMULATE THE THERMAL ENVIRONMENT IN A NUCLEAR LIGHT BULB ENGINE

Ward C. Roman Sep. 1970 77 p refs

(Contract SNPC-70)

(NASA-CR-110909; J-910900-4) Avail: NTIS CSCL 21F

Experiments were continued to develop an intense radiant energy source capable of producing radiant energy fluxes approaching those expected in a full-scale nuclear light bulb engine. The test program was conducted using the UARL 1.2 megw radio frequency induction heater operating at approximately 5.5 mHz. RF energy was deposited in an argon plasma discharge contained within a radial-inflow vortex. The 2.24 in ID test chamber was formed by concentric, water-cooled, fused silica tubes and a symmetric pair of copper end walls spaced 2 in. apart. The effects of various geometric, flow and RF parameters on the power radiated from the plasma, the power deposited in the surrounding water-cooled transparent peripheral wall, and the power convected away from the plasma were investigated. Tests were conducted at pressures up to 19.2 atm. A maximum heat deposition rate per unit volume of 0.57 megw/cu in. was achieved in the steady-state, ellipsoidal plasma. The maximum radiant energy flux achieved at the edge of the plasma was 49 kw/sq in. which corresponds to an equivalent black-body radiating temperature (based on the plasma surface area) of 10,860 R. Author

N71-10599# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

PRELIMINARY RESULTS OF THE BWR-FLECHT INTERNALLY PRESSURIZED, ZIRCALOY-CLAD BUNDLE, SPRAY COOLING TEST

J. E. Leonard and J. D. Duncan Jan. 1970 37 p refs Prepared for Idaho Nucl. Corp.

(Contract AT(10-1)-1230)

(NEDG-13064) Avail: NTIS

A 12-foot long, 40-rod, Zircaloy-clad BWR fuel bundle was spray cooled under loss-of-coolant conditions. The heater rods were electrically heated to simulate the post accident decay power transient. The rods were internally pressurized with argon to simulate fission product gas inventory. The temperature response and perforation of the bundle cladding is described. Spray cooling was effective in limiting cladding temperatures to approximately 2240 F in spite of the perforations and severe rod distortions which occurred near the center of the bundle. Author (NSA)

N71-10645# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

EFFECTS OF CLADDING TEMPERATURE AND MATERIAL ON ECCS PERFORMANCE

D. J. Liffengren Jun. 1970 62 p refs

(NEDO-10179) Avail: NTIS

The effects of cladding temperature and material on the boiling water reactor Emergency Core Cooling System (ECCS) performance are investigated. The experimental results of simulated full-length, full-size bundles with electrically heated rods subjected to cooling by spraying or flooding are presented. The results of these experimental tests indicate that the ECCS is effective at temperature levels significantly higher than those predicted, over the entire postulated loss-of-coolant accident (LOCA) break area range up to and including the design basis accident. Therefore, the ECCS can maintain basic core geometry and prevent melting of the fuel rod cladding. Furthermore, any effect of material on the performance of the ECCS is limited to temperature levels above approximately 2300 F where the metal-water reaction of the Zircaloy becomes significant. Also the basic differences in material properties can be accounted for by analysis. Author (NSA)

N71-10848# Addis Translations International, Woodside, Calif.

PULSED NEUTRON GENERATOR FOR REACTOR-PHYSICS RESEARCH [IMPULZUSUZEMU NEUTRON-GENERATOR REAKTOFIZIKAI CELOKRA]

Z. Szabo et al Albuquerque, N.Mex. Sandia Corp. Jun. 1970 22 p refs Transl. into ENGLISH from KFKI (Kozp. Fiz. Kut. Int.) Kozlemen. (Budapest), v. 17, no. 1, 1969 p 3-19 Prepared for Sandia Corp., Albuquerque, N.Mex.

(SCI-T-70-4021) Avail: NTIS

A D-T neutron generator (NIG-200) was developed and built for use in making multiplier-system measurements. The current at the target during a pulse was 5mA, the pulse length between 10 ms and 1 ms, the repetition frequency 0.1-2000 Hz, the maximum space factor 2%. The accelerator tube could be set at any angle

between vertical and horizontal in its own plane, and the height of the rotation axis could be varied between 0.9 and 2.0 m. The 200-kV accelerating potential was obtained with a split-core transformer. Author (NSA)

N71-10796# Rensselaer Polytechnic Inst., Troy, N.Y.
LINEAR ACCELERATOR PROJECT Progress Report, 1 Oct. – 31 Dec. 1969
31 Dec. 1969 24 p refs
(Contract AT(30-1)-328)
(RPI-328-173) Avail: NTIS

Research progress is summarized. The research included studies on neutron cross sections, and experimental and theoretical fast reactor physics and engineering. NSA

N71-10875*# Scientific Translation Service, Santa Barbara, Calif.
PRELIMINARY THERMODYNAMIC TRIALS OF THE HELIUM-COOLED REACTOR FUEL ELEMENT LOOP LV 17 WITH NATURAL CIRCULATION COOLING (THERMODYNAMISCHE VORVERSUCHE FUR DAS HE-GEKUHLTE BRENNELEMENTLOOP LV 17 MIT NATURUMLAUFKUHLUNG)
Wolfgang Krug Washington NASA Nov. 1970 25 p refs
Transl. into ENGLISH of German report JUL-630-RW
(Contract NASw-2035)
(NASA-TT-F-13397; JUL-630-RW) Avail: NTIS CSCL 18J

A test system was constructed so that natural circulation of high-pressure helium could be tested as a means of cooling reactor fuel element balls. Reactor conditions were simulated with graphite balls mounted on a rod, which had heating elements at positions corresponding to the ball centers. Various parameters were tested, of which helium pressure is the most important. Helium pressures up to 100 atmospheres were used. Author

N71-10884# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 May – 31 Jul. 1970
L. W. Steel, J. R. Hawthorne, C. Z. Serpan, Jr., and F. A. Smidt, Jr. 15 Aug. 1970 35 p refs
(Contract AT(49-5)-2110)
(AD-711321; NRL-MR-2153) Avail: NTIS CSCL 18/10

The report includes: (1) assessments of radiation resistant A533-B plate from a controlled composition 30-ton demonstration melt, (2) a study of through-thickness ductility in an irradiated reactor vessel wall, (3) neutron embrittlement in a simulated reactor pressure vessel wall, and (4) fundamental exploration of radiation damage in vanadium. Author (TAB)

N71-10920# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 31 Dec. 1969
P. Patriarca, comp. and D. J. Rucker, ed. May 1970 348 p refs
(Contract W-7405-eng-26)
(ORNL-4520) Avail: NTIS

Reports on research and development of nuclear fuels and materials are presented for fast reactors, space power reactors, and general reactors. Preparation, characterization, irradiation effects, mechanical and thermodynamic properties, and nondestructive testing of the fuels, cladding, and other structural materials are investigated. N.E.N.

N71-10929# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
LOCAL TEMPERATURES IN SODIUM-COOLED ROD BUNDLES CALCULATED WITH THE HELP OF A DIGITAL PROGRAM. PART 1: INFLUENCE OF THE HOUSING WALL OF THE FUEL ELEMENT
W. Baumann Sep. 1969 28 p refs In GERMAN
(KFK-1042) Avail: AEC Depository Libraries

The coolant temperatures in the subchannels of rod bundles with axial flow are calculated. The calculation method developed considers the radial expansion and the energy exchange between neighboring subchannels. The radial temperature distribution in the 19- and 61-rod bundles with spaced lattice containers is discussed. All bundles are in a hexagon guide tube and are heated equally over the cross section. The calculation shows that in the rhombus lattice and in a spiral wire the coolant temperatures in the central channel are considerably over the average temperature and those in the exterior channel are considerably under. In the beveled honeycomb lattice and in 3 and 6-fin bundles temperature profiles are obtained which deviate only slightly from the average temperature. With increasing rod number the temperature of the hot inner channel approached the average value, whereas the deviation of the cold wall channels was increased. Author (NSA)

N71-10929# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
RESULTS OF ERROR ANALYSIS FOR IN-PILE THERMAL CONDUCTIVITY DETERMINATIONS BY THE BALANCED OSCILLATOR METHOD
W. Daenner Jan. 1970 37 p refs In GERMAN
(KFK-1140) Avail: AEC Depository Libraries

With respect to the in-pile application of the Balanced Oscillator Method for measuring the fuel thermal conductivity and the gap conductance, a detailed error analysis has been performed. Observing the postulated optimal test conditions the thermal conductivity could be obtained with a precision of about 15 to 20%, the gap conductance with about 20 to 40% during the entire burnup of the specimen. Necessary improvements of the test loop instrumentation and essential experiments are advised. Author (NSA)

N71-10987*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS ON 400 fps IMPACT TESTS OF TWO 2-ft DIAMETER CONTAINMENT MODELS FOR MOBILE NUCLEAR REACTORS
R. L. Puthoff and T. Dallas Oct. 1970 21 p refs
(NASA-TM-X-52915; E-6018) Avail: NTIS CSCL 18F

Impact tests at 400 ft/sec were conducted on two 2-foot diameter spherical models. The feasibility of containing fission products of a mobile reactor in the event of an impact is studied. The first model tested was hollow sphere, weighed 350 lb and the second, designated the metal shield impact model weighed 990 lb. Both models absorbed the energy of impact through deformation of the spherical vessels. No leaks were detected nor cracks observed on either model. Author

N71-10993*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SPLIT-CORE HEAT-PIPE REACTOR FOR SPACE POWER APPLICATIONS
George Niedereuer and Edward Lantz [1970] 10 p refs
Presented at the 1970 Thermionic Conversion Specialist Conf., Miami Beach, Fla., 26 – 29 Oct. 1970; sponsored by IEEE
(NASA-TM-X-52918) Avail: NTIS CSCL 18L

The design and operation of small U-235C- and U-233C-fueled cores with axial heat pipes for a 350 kWe out-of-core thermionic power system was investigated. A split in the core at midplane was used for reactivity control. Each half core was built up from modules, each of which consisted of a fuel element with a central heat pipe that extended beyond the axial reflector. With 1cm-diameter heat pipes a typical U235 core has a 30cm diameter and contains 123kg of U235 and a typical U233 core has a 24cm diameter and contains 55kg of U233. The physics of the design concept are presented for both U-235C and U-233C systems. A

study of the startup dynamics of the reactor and heat pipes shows that ramp reactivity inputs should be limited to less than 2cents/sec for the U-233 reactor and less than 8 cents/sec for the U-235 reactor. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-10001# Electrotechnical Lab., Tokyo (Japan).
RECIPROCITY CALIBRATION OF LABORATORY STANDARD MICROPHONES IN A DIFFUSE SOUND FIELD
Takayuki Nakajima Jan. 1970 89 p refs In JAPANESE; ENGLISH summary *Its* Circ. No. 706
Avail: NTIS

The calibration of laboratory standard microphones in diffuse sound fields to establish primary specifications is discussed. Reciprocity calibration is conducted in a nitrogen-filled reverberation chamber. Frequency samples and space samples are processed by a digital computer. Diffuse field correction for the laboratory standard microphones has been obtained with a nearly equal precision to that obtained in the pressure response and free field correction. Author

N71-10004# IIT Research Inst., Chicago, Ill.
FIBER OPTICS WITH EXTENDED ULTRAVIOLET TRANSMISSION Triannual Report No. 8, 1 Jan. –30 Apr. 1970
M. A. Ali, A. G. Pincus, and M. A. Schwartz Aug. 1970 19 p refs
(Contract DAAB07-67-C-0542)
(AD-710241; ECOM-0542-8) Avail: NTIS CSCL 20/6

A series of clad glass compositions having lower coefficients of thermal expansion than the 25AT core glass were studied. One had a coefficient of 55.5 x 10 to the minus 7th power compared to 62.0 x 10 to the minus 7th power for the core glass. Author (TAB)

N71-10133# Royal Radar Establishment, Malvern (England).
STATISTICS OF HETERODYNE DETECTION OF GAUSSIAN LIGHT
E. Jakeman and E. R. Pike *In its* RRE Newsletter and Res. Rev., No. 8, 1969 6 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The statistical properties of the intensity fluctuations of light fields consisting of an incoherent Gaussian component heterodyned with a single-frequency coherent beam were investigated. An expression is given for the second moment of the intensity fluctuation distribution, and the excess normalized second factorial moment is graphed. N.E.N.

N71-10144# Royal Radar Establishment, Malvern (England).
THE PROBLEM OF HIGH DC CURRENT LEADS FOR CRYOSTATS
J. M. Lock *In its* RRE Newsletter and Res. Rev., No. 8 1969 6 p (See N71-10126 01-34)
Copyright. Avail: NTIS

The optimization of high current leads suitable for feeding magnets cooled to liquid helium temperatures is discussed. The heat flow equations applicable to the optimization of copper leads are developed. It is concluded that very low resistivity copper results in burn-out of the leads. F.O.S.

N71-10207# Royal Radar Establishment, Malvern (England).
SPECTRUM OF CLIPPED PHOTON COUNTING FLUCTUATIONS OF GAUSSIAN LIGHT
E. Jakeman and E. R. Pike *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

For simple optical fields, a single probability distribution of integrated intensity fluctuations was used to determine spectral parameters. Anormalized autocorrelation function and a normalized second factorial moment were calculated for clipped photon counting fluctuations of Gaussian light. J.A.M.

N71-10329# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL SINGLE FOURIER TRANSFORM OPTICAL PROCESSOR APPLIED TO FILM GRAIN ANALYSIS AND A SHIP WAVE DETECTION MEHOD
Robert Dale Ferguson (M.S. Thesis) Dec. 1969 71 p refs
(AD-710721) Avail: NTIS CSCL 14/5

A single Fourier transform optical system was constructed and tested on two projects. First, film grain in a single Fourier transform operation was studied and a mathematical model of the film grain and a semi-quantitative prediction of the grains transform were developed and verified using the experimental system. The film grain was found to have a noise-like spatial frequency spectrum which was a decreasing function of frequency, and that this spectrum could be considered Gaussian only in the case of fine grain films containing binary signal images. Second, the system was used to investigate a proposed method of detecting a ship wave. A deterministic relation between a ship wave and the Fourier transform of its photograph was shown to exist. A sample photograph of a ship wave was inserted into the system and operated on by a matched filter rotated in a plane normal to the optical axis. The output light intensity was determined as a function of the filter angular position. The output intensity when considered to be periodic was found to have a discernible spectral content due to the ship wave. Author (TAB)

N71-10380*# United Aircraft Corp., East Hartford, Conn. Research Labs.
OPTICAL ABSORPTION IN TRANSPARENT MATERIALS DURING 1.5 MeV ELECTRON IRRADIATION
Gary E. Palma and Ronald M. Gagosz Oct. 1970 76 p refs
(Contract SNPC-70)
(NASA-CR-110907; J-990929-1) Avail: NTIS CSCL 20F

A program of in situ optical experiments was conducted to determine the level of irradiation-induced optical absorption that exists in Corning Grade 7940 fused silica and single crystal aluminum oxide during steady-state 1.5 MeV electron irradiation. The optical transmission of a total of 25 fused silica specimens was measured during electron irradiation over a range of ionizing dose rates (0.02-10 Mrads/sec) and specimen temperatures (40-900 C). Three of these specimens were previously reactor irradiated to a dose of 10 to the 17th power fast neutrons per sq cm. In addition to measuring the transmission at the peak of the strong irradiation-induced absorption band centered at 2150 A, spectral scans over the wavelength interval 2050-2500 A were also made. The decay of the irradiation-induced absorption due to optical bleaching and the rate of recoloration following optical bleaching were measured in order to determine the effectiveness of optical bleaching and to obtain information relating to the damage mechanism responsible for the irradiation-induced absorption. The most surprising and important result was the low level of irradiation-induced optical absorption at dose rates equal to those expected in a nuclear light bulb engine which is believed to be due to radiation annealing. Author

N71-10397# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
INVESTIGATION OF THE APPLICATION OF COHERENT ACOUSTIC IMAGING TO NONDESTRUCTIVE TESTING

Semiannual Technical Report, 1 May – 31 Oct. 1969
Walter R. Arndt and Justin L. Kreuzer Apr. 1970 69 p refs
(Contract DAAG46-69-C-0010; ARPA Order 1245)
(AD-711085; PE-ER-9725; AMMRC-CR-70-14) Avail: NTIS CSCL 20/1

The purpose of this research program was to analyze and perform experimental demonstrations of the application of ultrasonic holographic and ultrasonic light diffraction techniques to the detection, analysis, and examination of the internal structure of optically opaque materials. During the period covered by this report, the electronic circuits for the ultrasonic camera were redesigned and the new hardware fabricated and tested. The revised system, described in detail in this report, has the inherent flexibility improved stability, and enhanced performance to permit the accurate generation of ultrasonic holograms. An elementary theory of the ultrasonic diffraction microscope is outlined in the report and some preliminary supporting experimental are described. Author (TAB)

N71-10415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE MIXED STATE OF SUPERCONDUCTORS
Wayne R. Hudson Washington 1970 73 p refs
(NASA-SP-240) Avail: SOD $0.40; NTIS CSCL 20C

The fundamental properties of superconductivity are reviewed. The Ginzburg-Landau equations are described and Abrikosov's solution is discussed. The vortex state is compared to a laminar state to determine which state is energetically more favorable. The experimental evidence that substantiates the vortex state is given. The results of tube magnetization experiments are presented, and the flux creep theory is derived. The flux flow models of Bardeen-Stephen and Nozieres-Vinen are compared with each other and with the experimental evidence. Three models for the viscosity coefficients are presented. The rigidity of the Abrikosov structure and the possible flux line pinning mechanisms are mentioned. Author

N71-10424# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL – 30 JUNE 1970
30 June 1970 62 p refs
(DME/NAE-1970(2)) Avail: NTIS

The facilities being used in a research and development program to assess the value of high speed liquid jets are discussed along with some of the difficulties experienced. Some of the applications that are suggested are no more than speculative, and have only been included to indicate the range of uses of the technique. Author

N71-10443# Aerospace Corp., El Segundo, Calif. Lab. Operations.
INTERFEROMETRIC MEASUREMENTS OF THE FAR-INFRARED REFRACTIVE INDEX OF SODIUM FLUORIDE AT LOW TEMPERATURES
Charles M. Randall 15 Jul. 1970 25 p refs
(Contract F04701-70-C-0059)
(AD-711064; TR-0059(9260-01)-1; SAMSO-TR-70-304) Avail: NTIS CSCL 20/6

The refractive index of sodium fluoride at cryogenic temperatures has been determined between 30 and 180/cm from channel spectra obtained by Fourier spectroscopy. Fitting the measured refractive index to a Lorentz oscillator model we find a low frequency dielectric constant of 4.70 and a damping parameter varying from 3.3/cm at 80K to less than 0.025/cm at 10K. Author (TAB)

N71-10448# Rochester Univ., N.Y. Inst. of Optics.
LENS TEST STANDARDIZATION STUDY Final Report, May 1967 – Feb. 1970
Robert E. Hopkins and David Dutton Jul. 1970 232 p refs
(Contract F33615-67-C-1642)
(AD-710633; AFAL-TR-70-93) Avail: NTIS CSCL 20/6

The aim of the study was to assess the current state of the art of measuring and computing the MTF/OTF of lenses or optical systems. It is intended to furnish guidance for the possible revision of Standard MIL- STD-150 A, should it appear desirable and feasible to make wider use of the MTF concept in writing specifications for or making physical evaluations of optical systems. Data were collected to make comparisons of results obtained by different laboratories: (a) of theoretical MTF values as computed from a lens design; (b) of actual measured MTF on a particular lens; and (c) to compare actual measurements with design predictions on the same lens. Author (TAB)

N71-10462# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report
H. J. Zimmerman, G. G. Harvey, and S. J. Mason 15 Jul. 1970 249 p refs
(Contracts DA-28-043-AMC-02536(E); N00014-67-A-0204-00)
(AD-710695; QPR-98) Avail: NTIS CSCL 9/4

Contents: Molecular beams; Radio astronomy; Solid-state microwave electronics; Electrodynamics of media; Plasmas and controlled nuclear fusion; Gaseous electronics; Processing and transmission of information; Detection and estimation theory; Speech communication; Linguistics; Cognitive information processing; Communications biophysics; Neutrophysiology; Signal processing. TAB

N71-10512# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
EFFECTIVE MASS AND MEDIAN FREE TRAVEL TIME DETERMINATION FOR GALLIUM CHARGE CARRIERS BY FREQUENCY AND TEMPERATURE DEPENDENCE OF SURFACE IMPEDANCE RESONANCES [BESTIMMUNG DER EFFEKTIVEN MASSE UND DER MITTLEREN FREIEN FLUGZEIT VON LADUNGSTRAEGERN IN GALLIUM AUS DER FREQUENZ- UND TEMPERATURABHAENGIGKEIT VON RESONANZEN DER OBERFLAECHENIMPEDANZ]
Peter H. Haberland (Ph.D. Thesis) 1968 113 p refs In GERMAN
Avail: NTIS

Frequency and temperature dependences of the surface impedance resonances are described and it is shown that radio frequency size effect resonances can be used to determine extreme Fermi surface measurements, cyclotron frequencies, and median free travel time and temperature dependence for certain groups of charge carriers. Radio frequency seize effect measurements on gallium crystals show that resonance frequencies decrease markedly at high frequencies. Transl. by G.G.

N71-10522# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.
RESONANT SCATTERING OF LIGHT IN THE OUTER MAGNETIC FIELD FOR MEASURING ABSOLUTE TRANSFER PROBABILITIES IN THE COBALT ISOTOPE SPECTRUM [RESONANZSTREUUNG VON LICHT IM AEUSSEREN MAGNETFELD ZUR MESSUNG ABSOLUTER UEBERGANGSWAHRSCHEINLICHKEITEN IM KOBALT I-SPEKTRUM]
Michael v. Hartrott (Ph.D. Thesis) 1969 88 p refs In GERMAN
Avail: NTIS

Life times and transition probabilities of atomic excitation lines in the cobalt isotope spectrum are determined by measuring resonant light scatter angle distributions. Hyperfine structure levels are deducted from level crossing signals and the lineon intersecting

angles for crossing Zeeman terms. Described is a level crossing experiment at the fine structure level z(4)F sub 9/2 in the Co spectrum where the relationship of the hyperfine structure fission constant with the Lande g-factor is determined by evaluating magnetic field positions of the signals. Transl. by G.G.

N71-10623# Technische Univ., Berlin (West Germany). Fakultaet fuer Allgemeine Ingenieurwissenschaften.

PRODUCTION AND OPTICAL PROPERTY STUDIES ON DIELECTRIC LAYERS AND HIGHLY REFLECTING LAYER SYSTEMS [HERSTELLUNG UND UNTERSUCHUNG OPTISCHER EIGENSCHAFTEN VON DIELEKTRISCHEN SCHICHTEN UND HOCHREFLEKTIERENDEN SCHICHTSYSTEMEN]

Walter Heitmann (Ph.D. Thesis) 1968 67 p refs In GERMAN
Avail: NTIS

Optical measurements on highly reflecting vapor-deposited zinc selenide layers found a 10% higher refractivity index when compared to zinc sulfide layers; absorption effects at wave lengths above 580 nm were absent. Studies on thorium fluoride and thorium oxyfluoride compounds produced only ThF4 layers through direct vapor depositions; thorium oxyfluoride dissociated at 1000 C into ThF4 and ThO2 and only thorium fluoride vaporized. The effects of various parameters on losses in multiple layers containing zinc selenide were observed and a production method for lambda/4 layer systems of ZnSe-Na3A1F6 and ZnSe-ThF4 with reflections up to 99.9% was developed. Reflection and dielectric interference measurements on individual layers during multiple layer vapor depositions were used to determine the quotients for maximal and minimal transmission and thus the refractive layer index. Values compared well with established data and differed only for layers deposited onto very porous substrates. Transl. by G.G.

N71-10551# Parke Mathematical Labs., Inc., Carlisle, Mass.

A SIMPLE MATHEMATICAL MODEL FOR THE ACOUSTIC RADIATION FROM A FREE-FLOODING RING TRANSDUCER

John L. Butler Jul. 1970 33 p refs
(Contract N00014-67-C-0424)
(AD-710745; R-0424-SR7) Avail: NTIS CSCL 9/1

A boundary collocation method is used to obtain the solution for the acoustic radiation from a free-flooding spherical segment. This model is then used as a representation for the radiation from a free-flooding cylindrical transducer. Numerical examples and comparisons with experimental results are presented. Author (TAB)

N71-10573# Naval Research Lab., Washington, D.C.

SELF-DEFOCUSSING OF A LIGHT BEAM: EXAMINATION OF A COMPUTATIONAL SCHEME

Herbert B. Rosenstock and J. Harrison Hancock Jul. 1970 13 p refs
(AD-710741; NRL-MR-2147) Avail: NTIS CSCL 20/6

A frequently used iterative scheme for computing self-defocussing of a light beam is examined critically. The phenomenon in question is the heating of a fluid by a light beam traversing it, thus producing a change in the index of refraction and deflection of the beam from the course it would take in vacuo. The iterative method utilizes the undeflected beam, rather than self-consistently the final resulting beam, to calculate the heating. A simple physical situation amenable to both exact solution and to several steps in the iterative scheme enables us to study the validity of the latter. It is found that the first step in the iteration, which is often the only one that can be taken, gives wholly incorrect results; indeed, the very convergence of the scheme is in doubt, in the sense that even a large number of steps give results that at large enough range differ by an arbitrarily large amount from the correct ones. Author (TAB)

N71-10595# Mississippi State Univ., State College. Dept. of Physics.

ON CAVITY EXCITATION THROUGH SMALL APERTURES Final Report

Leih-Wei Chen Jan. 1970 61 p refs Sponsored in part by AEC Prepared for Sandia Corp.
(SC-CR-70-6099) Avail: NTIS

The diffraction of plane waves by small apertures in a perfectly conducting plane screen is studied theoretically. A quasi-static solution technique is used for this problem. It is found that the far field may be expressed in terms of radiating electric and magnetic dipoles in the aperture. The transmission coefficient of the aperture is found to be simply related to ka, where a is the radius of aperture. Investigations are restricted to apertures which are of simple geometric shapes and which may be described in suitable coordinate systems, e. g., elliptical apertures. It is shown that the electromagnetic field in a cavity when excited through a small hole can be represented in terms of the normal modes of the cavity and the dipole moments of the aperture. Author

N71-10691# Army Electronics Command, Fort Monmouth, N.J. Inst. for Exploratory Research.

CRITICAL CURRENT ENHANCEMENT IN SUPERCONDUCTING LEAD SAMPLES OF VARYING CROSS SECTION

J. J. Winter, J. T. Breslin, and H. A. Leupold Jul. 1970 39 p refs
(AD-710957; ECOM-3316) Avail: NTIS CSCL 20/3

It is found that the superconducting critical currents of lead samples of a certain shape are frequently far below the values one would expect from the application of Silsbee's rule ((H sub c)(G) = (I sub c) (A)/5r(cm)). Values as low as 20%-25% of those expected are typical. By various mechanical and chemical treatments of the surface and through use of certain solders, these degraded critical currents can be greatly restored, sometimes even to their full expected value. The trapping of magnetic flux in a specimen is also capable of enhancing its resistance-free current capacity either partially or fully; the degree of enhancement depending in samples that trap appreciable amounts of flux, it is shown that its maintenance requires only negligible amounts. Infrequently, samples are encountered in which enhancement may also be attained merely by exposure to sufficiently high transport currents. Author (TAB)

N71-10705# School of Aerospace Medicine, Brooks AFB, Tex.

AIRSPEED INFLUENCE ON NOISE WITHIN FIXED- AND ROTARY-WING AIRCRAFT Research Report, Jan. 1966 - Oct. 1969

Donald C. Gasaway Jun. 1970 22 p refs
(AD-711359; SAM-TR-70-27) Avail: NTIS CSCL 20/1

The influence of increased motive power and airspeed on noise levels within 163 fixed- and rotary-wing aircraft is depicted in 9 noise-exposure envelopes. Increased power and airspeed resulted in increments in cockpit noise in all of these aircraft groups. Changes in acoustic spectra and speech interference are illustrated and described. Author (TAB)

N71-10706# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.

ACOUSTIC RAYS IN AN ARBITRARY MOVING INHOMOGENEOUS MEDIUM

Peter Ugincius and Bernd Zondek Aug. 1970 37 p refs
(AD-711319; NWL-TR-2446) Avail: NTIS CSCL 20/1

Two different formulations are presented in terms of ordinary second-order vector differential equations for acoustic rays in a three-dimensional medium moving with an arbitrary velocity (either subsonic or supersonic), and having an arbitrary index of refraction. The first formulation has the arc length of the ray as independent

variable, while the second one is given in terms of a canonical variable and is equivalent to Kellers Hamiltonian formulation. Author (TAB)

N71-10729# North Carolina State Univ., Raleigh. Dept. of Mathematics.
ON HALF-RANGE EXPANSION THEOREMS IN STUDIES OF POLARIZED LIGHT
E. E. Burniston and C. E. Siewart 27 Jun. 1970 19 p refs
(Grants AF-AFSOR-1779-69; NSF GK-11935)
(AD-710313; AFOSR-70-2058TR) Avail: NTIS CSCL 20/6

The established normal modes of the vector equation of transfer describing the transport of polarized light are used to construct solutions to typical half-space problems. The half-range completeness theorem required by this method is discussed in the context of systems of singular integral equations. Although the Riemann-Hilbert problem encountered here is defined in terms of continuous rather than Holder continuous functions, the existence of a canonical solution is established, and the developed properties of this canonical matrix are used to complete the proof of the necessary half-range expansion theorem. Author (TAB)

N71-10749# Army Electronics Command, Fort Monmouth, N.J.
A THERMALLY SCANNED INTERFEROMETRIC MODULATION EFFECT
Robert Mauro Jul. 1970 13 p refs
(AD-710954; ECOM-3310) Avail: NTIS CSCL 20/6

A thermally induced optical modulation effect has been observed in Cadmium Sulphide samples subjected to pulsed DC voltages and illuminated by a 6328 A He-Ne laser. It is shown that this phenomenon may be viewed as a scanning interferometric effect, which can be related to the electrical power dissipated in the crystal and the concomitant temperature rise in the material. Author (TAB)

N71-10857# Stanford Univ., Calif. Microwave Lab.
SELECTED STUDIES IN MICROWAVE ACOUSTICS Final Report, 1 Oct. 1965 - 31 Dec. 1969
B. A. Auld, A. Karp, J. H. Collins, H. J. Shaw, and D. K. Winslow Jun. 1970 123 p refs
(Contract AF 19(628)-5545)
(AD-711101; SU-ML-1860; AFCRL-70-0360) Avail: NTIS CSCL 20/1

The report describes research in the areas of Bragg diffraction from magnetostatic, and magnetoelastic waves and microcircuit resonators using acoustic surface waves, and unpublished work done prior to that time on the properties of thin film and bulk materials for acoustic resonators. It also includes abstracts of reports and publications under the contract in the areas of light diffraction by magnetic waves, studies of acoustic properties of materials related to microcircuit bulk wave resonators, generation and propagation of microwave acoustic waves in epitaxial YIG films, investigation of novel magnetoelastic variable delay lines, electronically controlled deflection and focusing of acoustic beams in magnetic and piezoelectric materials, efficient frequency doubling in ferrites, microwave dielectric resonators as circuit elements, and the theory of microwave thin film bulk wave transducers. Author (TAB)

N71-10858 Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
TABLES OF LIGHT SCATTERING. VOLUME 1: ANGULAR FUNCTIONS
K. S. Shifrin et al Lexington, Mass. Lincoln Lab. Apr. 1970 16 p refs Transl. into ENGLISH of the Publ. "Tablitsy po Svetorasseyaniyu. Tom 1: Uglovyye Funktsii" Leningrad, Hydrometeorol. Press, 1968 p 1-8 Prepared for Lincoln Lab.
(AZT-70-257-RULL) Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Tables of angular functions (derivative of the Legendre polynomial with respect to amplitude and derivative of the first associated polynomial with respect to angle) are necessary to describe the angular structure of a light field scattered by spherical particles of different dimension. The tables are six-valued and contain four hundred orders in each function. For small angles of scattering (up to 5 deg) the amplitude varies every 0.1 deg; for large angles, every degree. The rainbow region is also studied in detail. The tables are applicable to atmospheric optics, radiometeorology, actinometry, and lighting engineering, as well as in the optics of colloids and aerosols. Author

N71-10860 Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
TABLES OF LIGHT SCATTERING. VOLUME 3: COEFFICIENTS OF ATTENUATION, SCATTERING AND RADIATION PRESSURE
I. L. Zelmanovich et al Lexington, Mass. Lincoln Lab. Mar. 1970 21 p refs Transl. into ENGLISH of the publ. Tablitsy po Svetorasseyaniyu. Tom 3: Koeffitsiyenty Oslableniya, Rasseyaniya i Luchevogo Davleniya' Leningrad, Hydrometeorol. Press, 1968 p 3-12 Prepared for Lincoln Lab.
(AZT-70-202-RULL) Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Tables containing four-figure values of the cross sections and coefficients of attenuation, scattering, and radiation pressure for spherical particles are presented. Calculations are based on specific formulas of scattering theory for spheres of arbitrary size. The data of Section 1 pertain to transparent and absorbent spheres within a wide range of values of the diffraction parameter and the indices of refraction and absorption. Section 2 contains data for pure water droplets suspended in air. In Section 3 the data are based on the case with an index of refraction less than unity. The accuracy of the tables is discussed and they are compared with the tables given in other reports. Author

N71-10861# Syracuse Univ., Dept of Electrical Engineering.
COMPUTATION OF GREEN'S FUNCTIONS FOR BODIES OF REVOLUTION Interim Report
Roger F. Harrington and Joseph R. Mautz Jul. 1970 82 p refs
(Contract F19628-68-C-0160)
(AD-711099; AFCRL-70-0393; SR-6) Avail: NTIS CSCL 20/3

Computer programs are developed to calculate the electric field intensity at one point in space due to an electric dipole at another point in space, in the vicinity of a conducting body of revolution. The programs are valid both external and internal to the conducting surface. Hence, they may be used to compute not only radiated and scattered fields, but also fields internal to resonant cavities. The current on the conducting body is computed as an intermediary step in the program. The solution is obtained by the method of moments applied to the potential integral equation, and involves inversion of the generalized impedance matrix. The principal limitations to the solution are due to the matrix computation and inversion, which requires that the generating contour be at most several wavelengths long. Some examples of computations for spheres, disks, and cone-spheres are given to illustrate the programs. Author (TAB)

N71-10878# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
TRIBAND: THE THREE BAND FILTER FOR THE CONTINUING MIMI EXPERIMENT
Norman Hatter Feb. 1970 98 p refs
(Contract Nonr-1224(36))
(AD-703248; TR-201; Rept-3674-24-T) Avail: NTIS CSCL 20/1

An experiment was conducted as part of the continuing study of sound propagation in the Straits of Florida. A 420-Hz continuous wave (CW) signal was transmitted, received at the

7-mile hydrophone, and processed by the Linc-8 on-line digital processor. The processing yielded the magnitude and phase of the reception in a 1/16-Hz band, the magnitude of the reception in a 1-Hz band but excluding the 1/16-Hz band, and the magnitude of the reception in a 16-Hz band that excluded the 1-Hz band. All bands were centered at 420 Hz. The purposes of the experiment were to verify the possibility of such a three-band analysis and to obtain typical relative power ratios to aid in the design of analog triband phase coherent demodulation. Author (TAB)

N71-10911# Naval Academy, Annapolis, Md.
RADIATION INDUCED ACOUSTIC CAVITATION IN A SCINTILLATION LIQUID
Stephen W. Zavadil 15 May 1970 62 p refs
(AD-711286; USNA-TSPR-7) Avail: NTIS CSCL 20/4

The study attempted to establish a time correlation between the incidence of radiation in a liquid upon which a sound field was impressed, and the subsequent cavitation event. A scintillating liquid enclosed in a cavitation cell was considered ideal for such a study. An ionizing particle produced a scintillation event, and if of sufficient energy triggered a cavitation event. Both events are observable, and a time correlation could be established between them. Such a time correlation has not been established. Several problems of major import have been encountered. However, none of them are necessarily insurmountable. Suggestions are made for improvements which would allow this study to be carried to a fruitful conclusion. Author (TAB)

N71-10915# Notre Dame Univ., Ind. Coll. of Engineering.
THE EFFECT OF STRESS ON THE MAGNETOSTRICTION OF IRON, NICKEL AND 49 PERMALLOY
C. W. Allen, R. Haborak, and W. H. Kao Jul. 1970 59 p refs
(Contract N00014-68-A-0152)
(AD-711094; THEMIS-UND-70-9) Avail: NTIS CSCL 20/3

The effect of applied stresses on the technical magnetostriction curve, saturation magnetostriction and reversible magnetostriction at various levels of magnetization is examined experimentally and interpreted in terms of stress-induced changes in magnetization distribution. The different influences of employing hard and soft mechanical testing equipment in the application of stress in such experiments is considered. Experiments show that, while the effect of stress is to decrease the magnetomechanical coupling coefficients, K squared, for small field variations, superimposed stress may increase K squared by 50 percent when the field amplitude is made sufficiently large (e.g., for nickel, 250 oe). This result is important also from the point of view that the wrong stress distribution, applied or residual, intentional or accidental, can degrade transducer efficieny by a corresponding amount. Author (TAB)

N71-10918 Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
TEMPERATURE DEPENDENCE OF THE INITIAL PREMEABILITY OF A FERROMAGNETIC AMPORPHOUS Co-P ALLOY
J. G. M. DeLau Jul. 1970 10 p refs
(Contract N00014-67-A-0298-0009)
(AD-711087; TR-30) Avail: NTIS CSCL 20/3

The existence of amorphous solids which are ferromagnetic was predicted on theoretical grounds by Gubanov in 1960. Since then it has been demonstrated experimentally by a number of investigators. There have been several recent reports of magnetic property measurements on amorphous Fe-containing alloys made by rapid cooling from the liquid state. Tsuei, Longworth and Lin measured the magnetization as a function of the temperature of an amorphous Fe-P-C alloy and found a Curie temperature much lower than that of pure iron. Mossbauer experiments showed a nonunique hyperfine field at the nuclei which is consistent with a model of a disordered alloy with a spread in interatomic spacing. Sinha reported magnetization and paramagnetic susceptibility measurements on Fe-Mn-P-C alloys. He supposed that the magnetic structures are complex in some of the alloys: ferrimagnetism existing in conjunction with parasitic antiferromagnetism. Hasegawa found superparamagnetic clusters and also ferromagnetism in Pd-Fe-Si alloys. The Curie temperature is much lower as a result of the weaker exchange interaction in the amorphous alloy as compared to the corresponding crystalline alloy. This paper describes the measurements of the initial permeability of a ferromagnetic amorphous Co-P alloy made by electrodeposition. Author (TAB)

N71-10922 Aztec School of Languages, Inc., Maynard, Mass.
TABLES OF LIGHT SCATTERING. VOLUME 2: TABLES OF SCATTERING MATRICES AND STRAY FIELD COMPONENTS
K. S. Shifrin et al Apr. 1970 24 p refs Transl. into ENGLISH of the book "Tablitsy po Svetorasseyaniyu. Tom 2: Tablitsy Matrits Rasseyaniya i Sostavlyayushchikh Rasseyannogo Polya" Leningrad, Hydrometeorological Press, 1968 p 3–12 Prepared for Lincoln Lab., MIT
(AZT-70-258-RULL) Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Four-valued quantities of the scattering matrix and stray field components are given for scattering of visible and infrared radiation by water droplets. The tables contain the results of computation using precise formulas for diffraction of plane electromagnetic waves in the atmosphere. The tables include data that extend the values tabulated previously to cover a much more complete range of scattering parameters, enabling wide applications in many scientific and technical fields. Author

N71-10961 Lockheed Missiles and Space Co., Sunnyvale, Calif.
ANALYSIS OF A MICROWAVE OPTICAL MODULATOR UTILIZING A QUADRATIC ELECTROOPTICAL EFFECT
R. M. Dolgopiatov et al 1970 4 p refs Transl. into ENGLISH from Radiotekh. Elektron. (USSR), v. 15, no. 7, 1970 p 1542–1544
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The interaction between a light wave and a microwave frequency traveling wave in an anisotropic medium is investigated in a parametric approximation quadratic in the electrical field. The results obtained are used to analyze the operating modes of a quadratic electrooptical light modulation in the microwave frequency traveling wave and standing wave modes. Author

N71-10984*# California Univ., Berkeley. Dept. of Physics.
POLARIZATION DEPENDENCE OF STIMULATED RAYLEIGH-WING SCATTERING AND THE OPTICAL-FREQUENCY KERR EFFECT
R. Y. Chiao and J. Godine (MIT, Cambridge) Repr. from the Phys. Rev., V. 185, No. 2, 10 Sep. 1969 p 430–445 refs Sponsored in part by NASA and Army
(NASA-CR-111362; AD-700015) Avail: NTIS CSCL 20F

A theoretical study of the polarization dependence of stimulated Rayleigh-wing scattering and the optical-frequency Kerr effect has been undertaken. When the incident light is circularly polarized, a striking difference in gain is found for the co- and counter-rotating senses of polarization of the scattered light--the former being suppressed and the latter being exceptionally favored. Author (TAB)

N71-10988# Oak Ridge National Lab., Tenn. Technical Information Div.
MEASUREMENT OF ABSOLUTE INTENSITY OF DIFFUSE X-RAY SMALL-ANGLE SCATTERING. A PROCEDURE FOR WEIGHT AVERAGING IN MACROMOLECULAR SYSTEMS

O. Kratky Jun. 1970 33 p refs Transl. into ENGLISH from Z. Anal. Chem. (West Ger.), v. 201, no. 3, 1964 p 161-194
(PB-192682T; ORNL-tr-2344) Avail: NTIS CSCL 07D

Presented is a review of X-ray small angle research used to obtain the molular weight of polymers, especially biologically important polymers. USGRDR

N71-10989# Oak Ridge National Lab., Tenn.
MEASUREMENTS OF ABSOLUTE INTENSITY OF DIFFUSE X-RAY SMALL-ANGLE SCATTERING BY MECHANICAL ATTENUATION OF THE PRIMARY BEAM WITH APPLICATION OF THE PULSE-COUNT TECHNIQUE
O. Kartky et al Jun. 1970 8 p refs Transl. into ENGLISH from Monatsh. Chem. (Vienna), v. 94, no. 5, 1963 p 981-987
(PB-192683T; ORNL-tr-2343) Avail: NTIS CSCL 07D

In X-ray small-angle analysis the determination of the ratio of the scattered energy to the primary beam is a means of making determinations of mass (molecular weight, mass per unit of length in elongated particles, root mean square of the deviations in electron density). For measurement of the primary beam by the method of pulse counting it must be attenuated in a defined manner by many orders of magnitude, which can be done by means of a mechanical device which we call a 'rotator'. Principle, sources of error and necessary corrections are discussed. The absolute measurements made with this device in our field of study are briefly described. Author (USGRDR)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-10031# RAND Corp., Santa Monica, Calif.
THE WEAK INTERACTION HAMILTONIAN IN L-MATRIX THEORY
Alladi Ramakrishnan Jul. 1970 6 p ref
(AD-710572; P-4407) Avail: NTIS CSCL 20/8

During the past three years the author and his collaborators have made a systematic study of matrices A and B which satisfy the Clifford conditions A sup 2 = B sup 2 = I AB = -BA. It was demonstrated that there is a shell structure in the anticommuting matrices and a consequent telescoping of eigenvalues of an L-matrix which is a linear combination of anticommuting matrices. It is now observed that the form of the weak interaction Hamiltonian in elementary particle physics is an interesting manifestation of the shell structure. Author (TAB)

N71-10039# North Carolina Univ., Chapel Hill. Dept. of Physics.
NUCLEAR QUADRUPOLE INTERACTION IN CRYSTALS BY THE MOSSBAUER EFFECT Final Report, Feb. 1969-Jun. 1970
Dietrich Schroeer 30 Jun. 1970 8 p refs
(Grant AF-AFOSR-1716-69)
(AD-710293; AFOSR-70-1828TR) Avail: NTIS CSCL 20/8

The Mossbauer effect following Coulomb excitation by 3.3-MeV alpha particles has been observed in Dy-161 and Eu-151. Both the 43.8-keV state in Dy-161 and the 21.7-keV state in Eu-151 are promising candidates for studying the radiation damage produced by the charged-particle bombardment. No time dependence has been tected of the iron 1+ to 4+ charge states, resulting from the K-capture decay of Co-57 in sources of Cu2O, MgO and Al2O3. It was shown that CoO samples, produced by drying cobalt nitrate solutions at low temperatures, are made up of microcrystals. The Mossbauer isomer shift of Au197 has been measured in samples of gold microcrystals supported in gelatin, and can be correlated with the lattice contractions observed in these microcrystals. Both in bulk and microcrystal hematite no evidence has been found for a gradual Morin spin-flip transition. Author (TAB)

N71-10067# Brown Univ., Providence, R.I. Metals Research Lab.
INTERACTION OF DISLOCATIONS WITH ELECTRONS AND WITH PHONONS
A. Hikata, R. A. Johnson, and C. Elbaum Aug. 1970 35 p refs
(Contract N00014-67-A-0191-0011)
(AD-709940) Avail: NTIS CSCL 20/12

The interaction parameter, B, of moving dislocations with electrons and with phonons in aluminum was determined in the temperature range 10 degrees K to 250 degrees K. A new technique was developed for measuring ultrasonic attenuation changes, the change in alpha, as a function of a dynamic bias stress. The numerical values of B were obtained from an analysis of the change in alpha, which does not require any knowledge of dislocation density or of other inaccurately known features of the dislocation network. The results indicate that the dislocation interaction with electrons is temperature independent and the interaction with phonons increases with increasing temperature. These results are consistent with theoretical predictions. Author (TAB)

N71-10080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED ELECTRON CONVERSION RATIOS FOR THE 1064-keV GAMMA RAY OF BISMUTH-207
Sherwin M. Beck Washington Nov. 1970 40 p refs
(NASA-TN-D-6057; L-6015) Avail: NTIS CSCL 20H

The electron conversion ratios for the 1064-keV gamma ray of bismuth-207 were determined from the conversion electron spectra obtained by using lithium drifted silicon detectors. The spectrometer system had an energy resolution between 4 and 5 keV at 1 MeV, which was sufficient to separate the L and M shell conversion electron lines. Sixty-one measurements were made with four Si(Li) detectors. The average values obtained for the conversion ratios of K, L, and M shell electrons were K/L = 3.90, K/M = 11.23, K/L+M = 2.90, and L/M = 2.89. Author

N71-10301*# Norton Research Corp., Cambridge, Mass.
FEASIBILITY STUDY TO DETERMINE METHODS OF MEASURING THE TEMPERATURE OF A MOLECULAR BEAM Final Report
J. E. Hueser and P. Fowler [1970] 163 p refs
(Contract NAS1-8223-2)
(NASA-CR-66950) Avail: NTIS CSCL 20H

A basically different approach to the measurement of planetary atmospheric parameters, for example, the temperature of the earth's thermosphere, is presented. The measurement utilizes a molecular beam sampling inlet together with techniques for establishing the temperature based on the properties of the beam. The choice of particular instrument geometry as well as the selection of specific experimental apparatus are discussed in relation to three detection systems: (1) the metastable time-of-flight, (2) the flux angular distribution, and (3) the retarding potential energy distribution analysis techniques. Theoretical predictions are presented for the measurement sensitivity of the detection systems as well as discussions of simultaneously occurring noise signals, for example, the signals due to photon flux and neutral background flux. Data are presented for computer calculations of the theoretically predicted signal, which indicate that temperature measurements are possible in the thermosphere at an altitude of about 170 km. Author

N71-10308*# Carnegie-Mellon Univ., Pittsburgh, Pa.
TABLES OF URANIUM-THORIUM-LEAD DECAY-GROWTH FUNCTIONS

Truman P. Kohman *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p14–17 refs (See N71-10304 01-06)
Avail: NTIS CSCL 18B

Calculations involving the U-238–Pb-206, U-235–Pb-207, and Th-232–Pb-208 radioactive systems, particularly in geochronology applications, involve the use of exponential decay or growth functions, singly or in combinations of two or four exponentials involving a single time or two different times. Often the times are the quantities to be evaluated by means of these functions, but the combination functions cannot be solved analytically for the times. Consequently the solutions are usually obtained by successive trials or graphical methods, requiring that the functions be computed several times. To eliminate some of the tedium of these calculations, a set of six tables giving a total of approximately 15,000 values of functions have been computed and printed with an electronic computer. Author

N71-10307*# Carnegie-Mellon Univ., Pittsburgh, Pa.
SEARCH FOR LONG-LIVED TRANSURANIUM ALPHA EMITTERS AND OTHER ANOMALOUS ALPHA EMITTERS IN NATURAL MATERIALS
Nina Landes *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 18–30 refs (See N71-10304 01-06)
Avail: NTIS CSCL 18B

Rock samples were volatilized or underwent liquid and magnetic separation so that their spectra could be spectrometrically analyzed for transuranium alpha emitters. Studies ranged from 3 to 15 MeV, with particular attention focused on the 4.4 MeV region and on energies corresponding to normal anomalous pleochroic halos representing alphas of energies 9 to 10 MeV and the Y type of energy 6.55 MeV. Spectrometric analyses of non-volatile and volatile prepared granite samples detected no anomalous alpha activities. G.G.

N71-10311*# Carnegie-Mellon Univ., Pittsburgh, Pa.
SEARCH FOR NATURAL RADIOACTIVITY OF CALCIUM-48
Mark J. Yeager *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 57–64 refs (See N71-10304 01-06)
Avail: NTIS CSCL 18B

In searching for single beta decay of Ca48 the active daughter extraction technique is used to isolate Sc48 activity chemically from large amounts of calcium. Thus far the work has been concerned with the development of a procedure which removes any radioactive impurities and which can be conducted in a time which allows detection of the 44-hr half-life of Sc48. Five 1-Curie plutonium-beryllium neutron sources have been used to promote neutron-capture reactions of Ca46 and Ca48. The Sc47 activity (3.4-day half-life) and the Sc49 activity (1-hr half-life) serve as radioactive tracers for testing radiochemical procedures. Author

N71-10317*# Carnegie-Mellon Univ., Pittsburgh, Pa.
LEAST-SQUARES ANALYSIS OF EXPERIMENTAL ALPHA SPECTRA
Brij M. P. Trivedi *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 97–104 refs (See N71-10304 01-06)
Avail: NTIS CSCL 18B

For precise determination of the U234/U238 ratio of uranium from natural materials (tektites, rocks, lunar samples, etc.) and for alpha-isotope-dilution analysis of uranium and thorium using U232 or U235 and Th228 or Th230, respectively as spikes, a rigorous least-squares program has been developed to analyze the alpha spectra of these elements. Observed spectra of the samples show considerable low-energy tailing because of energy loss from the finite thickness of the sample, back scattering of alpha particles from the supporting material, and the range of angles at which the particles pass through the window of the semiconductor detector in high counting geometry. The alpha spectra are therefore represented by a modified Gaussian function. Author

N71-10333# Oregon Univ., Eugene.
REACTION Q VALUES FROM EPITHRESHOLD NEUTRON SPECTRA
D. W. Kneff, H. W. Lefevre, and G. U. Din (Australian Natl. Univ.) [1970] 11 p refs
(RLO-1925-40) Avail: NTIS

A thick target time-of-flight technique was employed to measure neutron energies for (p,n) resonance levels near threshold in medium-weight nuclei. Combining the results with proton energy measurements of these resonances, the following ground state (p,n)Q values were deduced: K-41, −1203.8 + or − 0.5 keV; Sc-45, −2843.6 + or − 4 keV; V-51, −1533.7 + or − 1.5 keV; and Fe-57, −1618.2 + or −2 keV. Author (NSA)

N71-10338# Pennsylvania Univ., Philadelphia. Dept. of Physics.
ALGEBRAIC APPROACH TO THE THEORY OF NUCLEAR STRUCTURE
R. M. Dreizler and Abraham Klein May 1970 28 p refs Presented at the Midwest Theory Conf., Notre Dame, Ind., 4 Apr. 1970 Sponsored by AEC
(NYO-2171-308; CONF-700411-2) Avail: NTIS

The approach to nuclear structure physics which seeks to obtain from the equations of motion and from kinematical algebraic restrictions (commutation relations, etc.) a calculus of directly observable matrix elements is reviewed in general terms. A detailed account is then given of a recent application to a model of particles in a single j level with pairing plus quadrupole-quadrupole interactions. Author (NSA)

N71-10343# Gulf General Atomic, San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Quarterly Progress Report, 1 Jan.–31 Mar. 1970
E. L. Slaggie, G. M. Borgonovi, D. H. Houston, and J. M. Neil 7 Apr. 1970 18 p refs
(Contract AT(04-3)-167)
(GA-10060) Avail: NTIS

Research progress on the integral neutron thermalization program during the period Jan. 1, 1970 to March 31, 1970, is described. The work included improvements to the FLANGE 2 code, energy mesh selection for thermal group-averaging, thermal benchmark calculations, and ENDF related activities. NSA

N71-10383*# Translation Consultants, Ltd., Arlington, Va.
DOUBLE SCATTERING IN THE PROCESS OF QUASI-ELASTIC INTERACTION OF PIONS WITH DEUTERONS [DVUKRATNOYE RASSEYANIYE V PROTSESSAKH KVAZIUPRUGOGO VZIMODEYSTVIYA PI-MEZONOV S DEYTRONAMI]
A. V. Tarasov et al Washington NASA Nov. 1970 12 p refs Transl. into ENGLISH from the Russian report
(Contract NASw-2038)
(NASA-TT-F-13384) Avail: NTIS CSCL 20H

The contribution of the double scattering amplitudes into the cross section of quasi-elastic scattering of pi-mesons by deuterons and the cross section of charge exchange of pi-mesons by deuterons in the mean energy region were investigated. Author

N71-10388# Atomics International, Canoga Park, Calif.
THE EVALUATION OF SEVERAL ENDF/B NUCLIDE CROSS-SECTIONS BY A MONTE CARLO TECHNIQUE
C. L. Dunford and H. Alter 15 Jan. 1970 28 p refs
(Contract AT(04-3)-701)
(AI-AEC-MEMO-12915) Avail: NTIS

The Monte Carlo code TYCHE 4 was used to calculate with a high degree of convergence the second, fourth, and sixth spatial moments of the slowing-down density distribution at the indium resonance energy, for neutrons originating from a fission

source at a point in infinitely extended light water, heavy water, graphite, aluminum/water, iron/water and zirconium/water moderators. These calculations, the results of which are compared with integral experiments, were done in support of the Phase 2 data testing effort for the ENDF/B neutron cross-section files. Author (NSA)

N71-10389# Battelle-Northwest, Richland, Wash. Metallurgy and Ceramics Dept.
EVALUATED REFERENCE CROSS SECTION LIBRARY
R. L. Simons and W. N. McElroy May 1970 105 p refs
(Contract AT(45-1)-1830)
(BNWL-1312) Avail: NTIS

This library of energy-dependent neutron-reaction cross sections exists for use in calculating the integral fluxes and fluences of fast and thermal test reactor environments. Calculations employing these cross sections are used in the analysis of irradiation tests of structural and fuel cladding material for the Liquid Metal Fast Breeder Reactor (LMFBR) Program. Recent evaluations of cross sections contained in this library and of uncataloged cross sections were used to update the library to achieve greater consistency and accuracy. The consistency of the 23 new and revised cross sections was shown by comparing calculated 2200 m/sec cross sections, resonance integrals, and fission-averaged cross sections with measured values and/or previously reported calculated values. Author (NSA)

N71-10392*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCATTERING OF 42-MeV ALPHA PARTICLES FROM Sc-45
William M. Stewart and K. K. Seth (Northwestern Univ.) [1970] 9 p refs Presented at the 1970 Fall Meeting of the Div. of Nucl. Phys. of the Am. Phys. Soc., Houston, 15-17 Oct. 1970
(NASA-TM-X-52912) Avail: NTIS CSCL 20H

The experiment was done using a cyclotron 42 MeV alpha particle beam. A schematic diagram of the scattering system is shown. The scandium target was a self-supporting rolled target of thickness 0.50 mg/sq cm. The energy resolution of the experiment was 80 to 100 keV and angular distributions were measured for 10 to 50 degrees in the center of mass system. A typical energy spectrum of the first 10 excited states is shown. The excitation energies are previously measured values. The data were reduced by fitting the peaks with a normal Gaussian function using a least-squares computer program with a linear background subtraction. The relative cross sections are known to an accuracy of + or - 3% and the absolute cross sections to an accuracy of + or - 10%. Author

N71-10395# Stichting Inst. voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
[EXPERIMENTAL NUCLEAR PHYSICS] Progress Report, 1969 - 1970
28 Jul. 1970 97 p
Avail: NTIS

Nuclear reaction research with cyclotron particles is reported including synchrocyclotron development and operation, a multidetector coincidence system (BOL) and experiments, few-body reactions, reactions on Be-9 and C-12, in-beam gamma-ray spectroscopy, a matrix method for three-nucleon problems, and digital electronics. An 85 MeV linear electron accelerator, a beam handling system, and electron scattering instrumentation and experiments in nuclear physics with fast electrons are described. Beta- and gamma-ray spectroscopy instrumentation and data reduction are reported as well as experiments with multichannel coincidence channel analyzers, light and heavy nuclei, isotopes, mass separators, and atomic mass calculations. Radio and nuclear chemistry instrumentation are included along with radioactive isotope studies, neutron measurements, activation analysis, biological and medical applications of radionuclides, hot atom chemistry, and radiation chemistry and measurements. J.M.

N71-10409# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
MULTILEVEL RESONANCE ANALYSIS OF THE TOTAL NEUTRON CROSS SECTIONS OF Na-23 AND Ca BELOW 1 MeV
J. Nebe and G. J. Kirouac May 1970 19 p refs Supported in part by EURATOM
(EURFNR-776; KFK-1195; IAEA-CN-26/13) Avail: NTIS

The total neutron cross sections Na-23 and Ca measured with the time-of-flight facility at the Karlsruhe Isochronous Cyclotron have been analyzed below 1 MeV in order to provide neutron resonance parameters. The analysis uses the standard multilevel R-matrix formulae for a single open channel. A chi-squared fitting procedure is used for shape analysis. Resonance widths and energies have been assigned for Na-23 up to 900 keV. The values of l and J have been determined up to 432 keV; above this energy the assigned J values are only lower limits. In the case of Ca, the parameters of resonances between 0.5 and 1.2 MeV have been determined. In many cases new differential data for Ca were used to verify the l value obtained by fitting the resonance. The channel radius and s- and p-wave strength functions of this nucleus are also discussed. Author (NSA)

N71-10416# Purdue Univ., Lafayette, Ind. Dept. of Physics.
PRECISION MEASUREMENT OF THE Hg 203 BETA-GAMMA DIRECTIONAL CORRELATION
S. J. Cipolla and R. M. Steffen [1970] 8 p refs
(Contract AT(11-1)-1748)
(COO-1748-41) Avail: NTIS

A precise measurement of the beta-gamma directional correlation of Hg-203 as a function of the average beta energy is reported. A-22 beta energy anisotropy coefficient values are given. Author (NSA)

N71-10418# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
TEST OF THE INDEPENDENCE HYPOTHESIS IN THE DECAY OF THE Po 210 COMPOUND NUCLEUS
P. Wong, P. J. Daly, and N. T. Porile 14 May 1970 23 p
(Contract AT(11-1)-1505)
(COO-1505-41) Avail: NTIS

The angular distributions, cross sections, and recoil ranges of Po-207 from the Pb-206(He-4,3n) and Pb-207(He-3,3n) reactions were measured over the energy intervals 32 to 44 MeV and 21 to 33 MeV, respectively. The compound nuclear nature of these reactions was established by comparison of the average ranges with values expected for this mechanism. The angular distributions were used to derive values of the average total kinetic energy of the neutrons and photons emitted in these reactions. The partition of the excitation energy between these two decay modes was found to be equal for the two reactions to within at most 1.5 MeV. The expected difference in energy partition arising from angular momentum differences is approximately 0.5 MeV. Author (NSA)

N71-10428*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR THE CALCULATION OF LARGE NUMBERS OF DIPOLE AND QUADRUPOLE TRANSITION PROBABILITIES
Lawrence P. Shomo, Goetz K. Oertel, and Charles S. Freer Washington Nov. 1970 40 p refs
(NASA-TN-D-5987) Avail: NTIS CSCL 20H

A computer program is presented which selects allowed transitions and calculates dipole and quadrupole transition

probabilities for transitions with LS coupling and no equivalent electrons, based on an extension of the Coulomb approximation formalism to quadrupole and higher multipole transitions. Absorption oscillator strengths or f-values calculated by (1) the self-consistent-field method, (2) the scaled Thomas-Fermi method, (3) the Coulomb approximation method, (4) the variational method, and (5) the effective charge method for singlet and triplet transitions in neutral helium are presented and compared. The Coulomb approximation f-values calculated with the present computer program are found to be in good agreement with the results obtained by the more sophisticated methods. Author

N71-10453*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THREE-DIMENSIONAL COLLISION INDUCED VIBRATIONAL TRANSITIONS IN HOMOGENEOUS DIATOMIC MOLECULES

C. Frederick Hansen and Walter E. Pearson Washington Nov. 1970 70 p refs

(NASA-TR-R-355; A-3606) Avail: NTIS CSCL 20H

The one dimensional, semiclassical theory of vibrational transitions is extended to three dimensions. Simple exponential interaction potentials are assumed and are spherically averaged to determine the collision trajectory that defines the perturbation. For use over the range of temperatures where small perturbation theory applies, fully analytic approximations are derived for the cross sections, the rate coefficients, and the relaxation rates. Vibrational transitions (predominantly changes of one vibrational level) are found to be accompanied by simultaneous rotational transitions (predominantly changes of zero and two rotational levels) with the result that vibrational transition rates are increased by 50% or more. The three dimensional theory enables one to determine both the gradient and the magnitude of the potential. The theory can be fit to data reasonably well by appropriate choice of an effective interaction potential. This potential is considerably steeper and of shorter range than potentials appropriate for scattering. It is concluded that the steeper inner potentials are primarily responsible for vibrational transitions, whereas the outer potentials are primarily responsible for scattering. Author

N71-10475# Oak Ridge National Lab., Tenn. Ecological Sciences Div.

COMSYS1: STEPWISE COMPARTMENTAL SIMULATION PROGRAM

Lewis J. Bledsoe and Jerry S. Olson Jul. 1970 70 p refs

Contract W-7405-eng-26)

(ORNL-TM;2413) Avail: NTIS

This report aims to help persons having only a slight acquaintance with calculus and the FORTRAN programming language to analyze the behavior of system of interconnected compartments, using COMSYS1 and related computer programs. The following sections include: (1) an introduction to compartment models; (2) the case of continuous flow between compartments; and (3) the case actually simulated in this program as a sequence of calculations in steps controlled by the user, accounting for simultaneous incomes and losses. Practical use is aided by directions on setting up input data and optional subroutines which permit nonlinear systems to be specified peripheral programs to aid in problem setup and analysis, FORTRAN program listings, examples, and a FORTRAN IV version using disc storage instead of magnetic tapes. Author

N71-10482# Iowa State Univ. of Science and Technology, Ames. Dept. of Metallurgy.

KINETICS OF LATERAL GROWTH

Gary Jermyn Jones (Ph.D. Thesis) May 1970 197 p refs

(Contract W-7405-eng-82)

(IS-T-357) Avail: NTIS

The problem of the advancement of an interface during phase transformations by the lateral growth mechanism is considered. The present model is concerned specifically with the case in which volume diffusion in the parent phase is the rate controlling process for precipitate growth. The ledges are assumed to be straight and to form right angle steps in the interface. The stability is treated on both macroscopic and microscopic levels, depending on the technique used to describe the interactions. Once the stability results are used to complete the proposed model, its predictions are compared with the available experimental data. Both solid-solid and liquid-solid results are studied and the agreement is found to be quite good. Author

N71-10503# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ATOMIC LINE TRANSITIONS AND RADIATION FROM HIGH TEMPERATURE AIR Annual Report, 15 Jun. 1969 – 15 Jun. 1970

Robert R. Johnston, Oscar R. Platas and Ludwig M. Tannenwald 15 Jul. 1970 155 p refs

(Contract N00014-68-C-0481; ARPA Order 925)

(AD-710799; LMSC-N-3L-70-1) Avail: NTIS CSCL 7/4

The status of the current investigation into the radiant emission from high temperature air is described. A treatment of emission by molecular species and some new results in line broadening is included. Results are presented for air at temperatures 0.5 to 5.0 eV and densities from 1.0 to 0.0001 times normal. Author (TAB)

N71-10520# California Univ., Livermore. Lawrence Radiation Lab.

ANALYSIS OF BIOLOGICAL MATERIALS WITH THE ELECTRON MICROPROBE

William L. Robison 8 Jun. 1970 34 p refs Presented at 3rd Symp. on Low-Energy X- and Gamma-ray Sources and Appl., Boston, 10-12 Jun. 1970 Sponsored by AEC

(UCRL-72513; Conf-700611-1) Avail: NTIS

Two problems investigated with the electron microprobe are discussed. One involves the analysis of human thyroid glands for iodine, phosphorus, and calcium, using a quantitative approach involving the preparation of suitable biological standards and operation at low accelerating potentials such that the sample looks infinitely thick to the primary electron beam. In a few instances, potassium, sodium and chlorine distributions were also determined. The other involves the analysis of the sodium and potassium content in the nucleus of ascites tumor cells after various doses of radiation. Author

N71-10521# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.

A FORTRAN 4 COMPUTER PROGRAM FOR CALCULATING INTERPLANAR SPACINGS

A. L. Coffey, Jr. 15 Jul. 1970 25 p refs

(Contract W-7405-eng-26)

(Y-1729) Avail: NTIS

A time-share FORTRAN computer program was developed which reliably calculates values of interplanar spacings, and the crystallographic planes, hkl, for materials whose unit cell parameters and extinction conditions are known. Calculated reflections that are systematically absent because of space group or translational symmetry are eliminated from the output list. Author

N71-10524# Technische Univ., Berlin (West Germany). Fakultaet Fuer Allgemeine Ingenieurwissenschaften.

THE EFFECT OF MUTUAL EXCHANGE ACTION ON THE EXCITON SPECTRUM [DER EINFLUSS DER AUSTAUSCHWECHSELWIRKUNG AUF DAS EXZITONENSPEKTRUM]

Peter Rohner (Ph.D. Thesis) 1968 71 p refs In GERMAN

Avail: NTIS

The equivalence Hamiltonian operator is used to describe the crystal ground level by a two particle system and to deduct a valid formulation for the exciton. Developed is an approximative quantum mechanical substitution system for the N-electron problem where the absorption of a photon represents a cross transfer between two levels in the exciton system. Emphasis is placed on the mutual exchange action that modifies the energy spectrum of the exciton and the selection rule for optical transfers. Transl. by G.G.

N71-10534# Naval Postgraduate School, Monterey, Calif.
ENERGY LOSS OF HIGH ENERGY ELECTRONS IN TIN, LEAD, AND GADOLINIUM
Michael Lee Mosbrooker (M.S. Thesis) and David Lee Sandquist (M.S. Thesis) Jun. 1970 81 p refs
(AD-711005) Avail: NTIS CSCL 20/8

The LINAC at the Naval Postgraduate School, Monterey, was used to accelerate electrons to energies ranging from 52 to 92 MeV in order to study the energy distributions of high energy electrons before and after passing through layers of tin, gadolinium, and lead. The thickness of these materials ranged from 0.8 to 5.9 g/sq. cm. The most probable energy losses agreed with the theory of Blunck and Westphal for all materials used, while distribution half-widths agreed only for absorbers of thickness less than 3.0 g/sq. cm. The thickness at which theory and experiment began to exhibit a noticeable discrepancy was found to be dependent on the atomic number of the material. Where comparison was possible, results of this experiment generally agreed with the findings of similar works concluded previously. Author (TAB)

N71-10549# Bendix Corp., Southfield, Mich. Research Labs.
INVESTIGATION OF STIMULATED TWO-PHOTON EMISSION Final Report, 1 Dec. 1968 - 10 Jul. 1970
P. Braunlich 10 Jul. 1970 24 p refs
(Contract DAHC04-69-C-0030)
(AD-711120; BRL-5280; AROD-7891.2-P) Avail: NTIS CSCL 20/6

An experimental arrangement is described that was designed for the detection of vacuum uv photons generated by stimulated two-photon emission and by Raman scattering from metastable deuterium atoms. A collimated beam of metastables is produced by charge exchange between cesium vapor and 5 keV deuterons. A pulsed Nd-glass laser is used for the stimulation. The generated 1373 A photons are detected at the exit slit of a spectrometer. Single photon counting techniques are employed. The first observation of singly-stimulated two-photon emission from a metastable atom is reported. The results are compared with the calculation of W. Zernik. Author (TAB)

N71-10560* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FORMING THIN WINDOW DRIFTED SILICON CHARGED PARTICLE DETECTOR Patent
Theodore E. Fessler, Albert B. Smith, and John Samuel Vincent, inventors (to NASA) Issued 21 Mar. 1967 (Filed 6 Sep. 1963) 5 p Cl. 148-188
(NASA-Case-XLE-00808; US-Patent-3,310,443; US-Patent-Appl-SN-307269) Avail: US Patent Office CSCL 20H

A thick junction radiation detector is produced by: (1) evaporatively depositing a thin coating of aluminum to one side of a p-type silicon body; (2) painting a suspension of lithium and oil to the opposite side of this body; (3) heating the body in a nitrogen atmosphere at 450 C to diffuse the lithium into the body and form an n-type region; (4) applying heat and an electric field at 250 volts and 15 milliamperes to initiate drifting of the lithium in the silicon body; (5) maintaining the amperage and voltage at constant rates for a time proportional to the cube of the thickness of the silicon body to form a thick depletion region; (6) etching to remove surface imperfections; (7) depositing a thin gold coating to the etched sides of the intrinsic silicon to provide reactive contacts; and (8) applying electrical contacts to the gold coating by layering a spot epoxy cement and silver paint. E.C.

N71-10571# Windsor Univ. (Ontario). Dept. of Physics.
COLLISIONAL AND RADIATIVE PROCESSES IN ATOMS AND MOLECULES AT LOW ENERGIES Final Report
L. Krause 20 Mar. 1970 6 p
(Contract N00014-67-C-0538; ARPA Order 125)
(AD-711110) Avail: NTIS CSCL 7/4

Very briefly summarized is research dealing with quenching and trapping of resonance radiation, excitation transfer between resonance states, and disorientation of magnetically aligned atoms in collisions involving alkali metal atoms. Author (TAB)

N71-10584*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY EXCITED LMM AUGER SPECTRA OF COPPER, NICKEL, AND IRON
L. I. Yin, E. Yellin, and I. Adler Oct. 1970 27 p refs Submitted for publication
(NASA-TM-X-65381; X-641-70-393) Avail: NTIS CSCL 07D

Photoelectron and Auger electron spectra are both obtained with X-ray excitation. Using the photoelectron spectra as internal energy standards, the energies of the prominent LMM Auger lines in Cu, Ni, and Fe were accurately determined. In addition, the photoelectron spectra provide a measure of the vacancy distribution created by the X-rays among the three L-subshells. Thus, knowing both the energy values and the vacancy distribution, the three prominent Auger lines of Cu, Ni, and Fe are assigned to be of type L (sub 3) MM rather than L (sub 2) MM. Author

N71-10598# Bettis Atomic Power Lab., Pittsburgh, Pa.
INTEGRAL MEASUREMENTS OF THE Pa-233 NEUTRON CAPTURE CROSS SECTION (LWBR DEVELOPMENT PROGRAM)
J. C. Connor Jun. 1970 30 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-837) Avail: NTIS

The thermal neutron capture cross section and resonance integral of Pa-233 were measured by irradiating bare and cadmium-covered thorium wires, and, after suitable chemical separations, determining the amounts of U-233 and U-234 produced. Earlier results reported for the resonance integral are reviewed and additional data are included. The cadmium-covered thorium data now provide an average Pa-233 resonance integral result of 857 + or - 35 barns, which is 15 barns higher than the value reported previously. This result includes the 1/v component of the cross section and is appropriate for a 1/E spectrum and a perfect filter with a low energy cutoff of 0.5 eV. The bare thorium wire data provide an average 2200 m/sec Pa-233 cross section result of 38.3 b. Author (NSA)

N71-10619# Washington Univ., Seattle.
ELASTIC SCATTERING OF O 18 BY O 18
R. W. Shaw, Jr., R. Vanderbosch, and M. K. Mehta 1969 14 p refs Sponsored in part by AEC
(RLO-1388-123) Avail: NTIS

The excitation function at 90 deg c.m. was measured for O-18 + O-18 between 7.5 and 27.5 MeV c.m. The prominent gross structure observed in O-16 + O-16 is not seen, and the absolute cross section falls to much lower values at high energies. The results of the comparison of the two systems are discussed in terms of angular momentum restrictions on configurations directly coupled to the elastic channel. Author (NSA)

N71-10634# European Organization for Nuclear Research, Geneva (Switzerland).
POSSIBILITIES OF PERFORMING NEUTRINO

EXPERIMENTS WITH THE IHEP ACCELERATOR [POSSIBILITIES DE REALISATION DES EXPERIENCES NEUTRINO AUPRES DE L'ACCELERATEUR DE L'IFVE]

V. N. Bolotov et al Nov. 1969 214 p refs Transl. into FRENCH of Inst. Fiz. Vysokikh Energii Report IFVE-SEF/STF/OP/SKU-68-56K In FRENCH

(CERN-Trans-69-26; IFVE-SEF/STF/OP/SKU-68-56K) Avail: NTIS

The discussion of the possibilities of neutrino experiments using the IHEP accelerator covers neutrino spectra with the IHEP accelerator and principal elements of the neutrino channel, proposed detectors for these experiments, various possibilities for physical study of the neutrino, and the possibilities of studies with the muon. NSA

N71-10635# Bettis Atomic Power Lab., Pittsburgh, Pa.

EPOCH: A PROGRAM TO CALCULATE NEUTRON AGES USING THE ENDF/B LIBRARY Interim Memorandum

J. D. Butler, E. M. Gelbard, and E. Schmidt May 1970 25 p refs Addendum 1 to WAPD-TM-822

(Contract AT(11-1)-GEN-14)

(WAPD-TM-822-Add-1) Avail: NTIS

The program EPOCH (BD05), an extension of programs previously described, obtains nuclear cross sections from the ENDF/B Library and determines fine detail P-1 flux spectra for simply buckled media using up to 2000 lethargy groups. Neutron flux ages are computed from multiple spectra calculations by varying the buckling. The program ignores the ENDF/B resonance files since the number of groups required to accurately describe the cross section shapes in the resonant range becomes impractical for an analytic program. Thus EPOCH is most useful for higher energies and where resonant reactions are weak or absent. Author (NSA)

N71-10637# Naval Research Lab., Washington, D.C.

INTRINSIC EFFICIENCY OF THERMOLUMINESCENT DOSIMETRY PHOSPHORS Final Report

William H. Lucke 13 Aug. 1970 43 p refs

(Contract AT(49-7)-1864)

(AD-711588; NRL-7104) Avail: NTIS CSCL 6/18

The intrinsic efficiency is defined as the ratio of light energy emitted during heating to energy absorbed during gamma irradiation. This factor was measured for four commonly used thermoluminescent phosphors to give the following results: LiF(TLD-100), 0.039%; Li2B4O7:Mn, 0.073% (both corrected for supralinearity); CaF2:Mn, 0.44%; and CaSO4:Mn, 1.2%. The method of measurement involved calibrating a detector, which consisted of a narrow bandpass filter in conjunction with a photomultiplier, by means of the light of a standard lamp diffusely reflected from a MgO button having the same size, shape, and position as the phosphor-bearing planchet. A correction was made to account for the fact that the phosphor samples were not Lambertian sources. Author (TAB)

N71-10647# California Univ., Livermore. Lawrence Radiation Lab.

U-235 AND Pu-239 CAPTURE-TO-FISSION RATIO

J. B. Czirr and J. S. Lindsey 4 May 1970 14 p refs Presented at the 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki, 15–19 Jun. 1970 Sponsored in part by AEC

(UCRL-72454; CONF-700605-3) Avail: NTIS

A new experimental technique has been used to measure the neutron capture-to-fission cross-section ratio, alpha, for U-235 and Pu-239. Data were obtained in the 0.1 eV to 30 keV energy range using neutron time-of-flight methods, with the Livermore 33-MeV linac providing a pulsed neutron source. The detector for both capture gammas and fission neutrons was a one-liter liquid scintillator viewed by a single 5-in photomultiplier tube. Fission neutrons were identified by pulse-shape-discrimination techniques applied to the signals from the deuterated-benzene scintillator. Capture and fission gamma events were pulse-height weighted on-line in order to obtain a signal which is independent of variations in the gamma spectra. The use of deuterated benzene as the scintillator solvent reduced the background arising from the capture of scattered neutrons. The fission-gamma contamination of the capture data was removed by a subtraction technique based on normalization at a resolved resonance with small capture-to-fission ratio. Author

N71-10660# Princeton Univ., N.J.

NUCLEAR PHYSICS Progress Report, Apr. 1969–Apr. 1970

Apr. 1970 40 p refs

(Contract AT(30-1)-937)

(PUC-937-378) Avail: NTIS

Research progress from April 1969 to April 1970 is summarized. The work included development and operation of the AVF cyclotron and the associated experimental facilities, theoretical and experimental studies of nuclear reactions and nuclear structure, and studies on the use of atomic beams in nuclear physics. NSA

N71-10671# Douglas United Nuclear, Inc., Richland, Wash.

NOBLE GAS CONFINEMENT STUDIES Quarterly Report, Oct.–Dec. 1969

J. E. Mecca, E. L. Etheridge, and H. F. Jensen Dec. 1969 47 p refs

(Contract AT(45-1)-1857)

(DUN-6653) Avail: NTIS

The development of two possible methods of controlling the releases of chemically inert gaseous, fission products (xenon and krypton) which would occur as a result of fuel melting accidents is described. Methods being investigated are encapsulation in a high expansion foam, and adsorption in a porous cryogenic bed. Author (NSA)

N71-10680# Ballistic Research Lab., Aberdeen Proving Ground, Md. Nuclear Effects Lab.

A MULTIPLE COLLISION METHOD OF MEASURING STICKING COEFFICIENTS

Ralph F. Benck, Ernest W. Bloore, and John W. Ward (Los Alamos Scientific Lab.) Jun. 1970 34 p refs

(Contract AT(49-7)-2883)

(AD-710969; BRL-1484) Avail: NTIS CSCL 7/4

A new method of measuring sticking coefficients using multiple surface collisions of vapor is presented. Metal vapors pass from a cup into a long, hollow, right cylindrical tube where they come to rest after one or more collisions on the inner surface of the tube. The distribution of the condensed vapors on the inner surface is then analytically measured and analysis of the distribution is made by applying Monte Carlo calculational techniques to the behavior of atoms in a tube (similar to the experimental array) and making various assumptions regarding sticking coefficients and types of reflections. Some of the problems concerned with the elucidation of the variables in sticking coefficient measurements and the attainment of meaningful equilibrium oxide surfaces under ordinary vacuum conditions are discussed. Author (TAB)

N71-10686# Aerospace Corp., El Segundo, Calif. Lab. Operations.

ANALYTICAL CROSS SECTIONS FOR INELASTIC COLLISIONS OF PROTONS AND HYDROGEN ATOMS WITH ATOMIC AND MOLECULAR GASES Research Report, Jul. 1969–May 1970

A. E. S. Green (Fla. Univ., Gainesville), and R. J. McNeal 15 Jul. 1970 47 p refs Prepared in cooperation with Fla. Univ., Gainesville

(Contracts F04701-70-C-0059; AT(40-1)-3798)

(AD-711661; TR-0059(9260-01)-3; SAMSO-TR-70-281) Avail: NTIS CSCL 7/4

Convenient analytic formulas are given for inelastic cross sections for collisions of protons and hydrogen atoms with atomic and molecular gases in the 0.5 keV - 5 MeV energy range. Essentially, they are convenient interpolation formulas that span the broad energy region important in atmospheric physics, astrophysics, radiation physics, and plasma physics. The asymptotic form of the analytic expressions is shown to be equivalent in appropriate cases to theoretical results obtained with the well-known Born approximation. The parameters of the formulas are evaluated for noble gases and for diatomic atmospheric gases with the aid of electron impact data and recent experimental results of proton and hydrogen atom impact experiments. The systematics of the parameters are discussed. Author (TAB)

N71-10697# Washington Univ., Seattle. Dept. of Physics.
HIGH ENERGY NEUTRON-LIQUID He-4 SCATTERING AND THE He-4 CONDENSATE DENSITY
R. D. Puff and J. S. Tenn [1969] 22 p refs
(RLO-1388-566) Avail: NTIS

A simple theory of high-energy neutron scattering from liquid He-4 is developed. The inelastic scattering cross section for this process is related, for sufficiently high momentum transfer, to two parameters characterizing the He-4 momentum distribution. These two parameters are the average kinetic energy per particle and the fraction of particles in the zero momentum condensate. Comparison of the theory with recent experimental data indicates that the condensate fraction is approximately 0.08 to T = 1.27 K. Author (NSA)

N71-10698# Washington Univ., Seattle.
MASS DETERMINATIONS OF THE NEUTRON-DEFICIENT NUCLIDES Zr-88 AND Nd-140 BY (P,2n) THRESHOLD MEASUREMENTS
P. A. Russo and P. Vandenbosch [1969] 16 p refs
(RLO-1388-124) Avail: NTIS

Masses of Nd-140 and Zr-88 were determined from measured thresholds of Pr-141 (proton, 2 neutron) and Y-89(proton, 2 neutron reactions. Thresholds extracted from fits of the data with the Jackson neutron evaporation model produce mass excess values of −83.57 + or − 0.04 MeV for Zr-88 and −84.26 + or − 0.06 MeV for Nd-140. Measured masses are compared to existing data and to calculations based upon several semiempirical mass formulas. Author (NSA)

N71-10703# California Univ., Livermore. Lawrence Radiation Lab.
A keV FISSION CROSS SECTION OF U-235 MEASURED WITH HIGH RESOLUTION
C. D. Bowman, M. L. Stelts, and R. J. Baglan 13 May 1970 21 p refs Presented at the 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki, 15-19 Jun. 1970 Sponsored in part by AEC
(UCRL-72472; CONF-700605-2) Avail: NTIS

The fission cross section U-235 was measured with a resolution of 1 nsec/meter from 1.5 to 500 keV. Structure in the cross section was detected at neutron energies as high as 200 keV. It is shown that, while the structure has had no appreciable effect on the accuracy of other keV measurements carried out with nearly monoenergetic sources of neutrons, care will be necessary in future attempts to satisfy requests for cross section accuracy of a few percent or less. The resolution of the experiment probably is sufficient to reveal much more structure than was actually observed. The structure which is observed, therefore, might be interpreted as intermediate structure in the average cross section. Author (NSA)

N71-10710# Addis Translations International, Woodside, Calif. Sandia Corp., Albuquerque, N.Mex.
OPTICAL METHOD FOR ESTIMATION OF THE AMORPHOUS COMPONENT IN PYROLYTIC CARBON, PART 1
K. Koizlik et al [1970] 18 p refs Transl. into ENGLISH from the German Report Jul-589-RW Prepared for Sandia Corp., Albuquerque
(SC-T-70-4023; JUL-589-RW) Avail: NTIS

The orientation anisotropy of pyrolytically deposited carbon layers is usually determined by x-ray. A previously used light-optical determination is based on the refraction measurement by means of a microscope photometer on pyrolytic carbon to establish relations between the optically measured and x-ray determined anisotropy factors. The necessity of modifying this relation is shown. The equation is expanded so that it can be used to consider the structure of pyrolytically deposited carbon originating both as amorphous and crystalline carbon. Since the amorphous fraction is given only in the optically determined anisotropy factor, the combination of both methods permits an estimation of the amorphous fraction. Author (NSA)

N71-10711# Washington Univ., Seattle.
THE He-3/H-3 CHARGE FORM FACTOR AND THE He-3 COULOMB ENERGY
J. L. Friar Nov. 1969 18 p refs
(RLO-1388-575) Avail: NTIS

A formula for the Coulomb energy difference of He-3 and H-3 is derived on the assumption that the trinucleon S-state wave function and the symmetric part of the S'- and D-state wave functions can be represented as a linear superposition of Gaussians. The formula contains only experimentally measured quantities, since the nuclear physics can be parametrized directly in terms of the observed He-3 and H-3 charge from factors. The result for the Coulomb energy difference is 0.64 + or − 0.01 MeV. Author (NSA)

N71-10716# Purdue Univ., Lafayette, Ind. Dept. of Physics.
ENERGY DEPENDENT BETA-GAMMA CIRCULAR POLARIZATION AND NUCLEAR MATRIX ELEMENTS OF Rb 86
J. J. Boeken, D. E. Ohlms, and P. C. Simms [1970] 16 p refs Sponsored by AEC
(COO-1746-42) Avail: NTIS

The energy dependent beta-gamma circular polarization was measured in order to set better limits on the matrix element ratio lambda for the 696-keV first forbidden beta transition of Rb-86. The results show that lambda is consistent with the Fujita-Eichler relation, so the contributions of the off-diagonal matrix elements of the coulomb hamiltonian to lambda are small for this transition. The nuclear matrix elements are in agreement with previous results, but the limits of error were reduced. Author (NSA)

N71-10717# Washington Univ., Seattle. Dept. of Nuclear Engineering.
THE MEASUREMENT OF DELAYED NEUTRON ENERGY SPECTRA Annual Progress Report, 1 Apr. 1969 − 1 Feb. 1970
Gene L. Woodruff Feb. 1970 10 p refs Sponsored by AEC
(Contract AT(45-1)-2215)
(RLO-2215-1) Avail: NTIS

The progress made in a project to measure delayed neutron spectra of thermally fissioning nuclei is reported. The preliminary work has included target preparation, development of a target irradiation system, and development of a data acquisition and storage system. NSA

N71-10718# Oak Ridge National Lab., Tenn. Neutron Physics Div.
NEUTRON ELASTIC AND INELASTIC-SCATTERING CROSS SECTIONS FOR Si IN THE ENERGY RANGE 4.19 TO 8.66 MeV

W. E. Kinney and F. G. Perey Jul. 1970 62 p refs
(Contract W-7405-eng-26)
(ORNL-4517) Avail: NTIS

Numerical values are presented for neutron elastic-scattering cross sections for natural Si and cross sections per atom of natural Si for inelastic scattering to levels Si-28 for incident neutron energies from 4.19 to 8.56 MeV. The data are in reasonable agreement with the results of others. The ENDF/B evaluated Si cross sections are, with few exceptions, in good agreement with experimental data. Author (NSA)

N71-10736# Tel-Aviv Univ., (Israel). Dept. of Physics and Astronomy.

ALGEBRAIC APPROACH TO ELEMENTARY PARTICLE DYNAMICS Final Scientific Report, 1 Apr. 1968 – 31 Mar. 1970

Yuval Neeman 6 Aug. 1970 10 p refs
(Grant EOOAR-68-0010)
(AD-711441; AFOSR-70-2326TR) Avail: NTIS CSCL 20/8

The report mentions dispersion theory, algebraic theory, and charge parity violations of elementary particles. TAB

N71-10744# Union Carbide Corp., Oak Ridge, Tenn. Computer Technology Center.

A MICROSCOPIC ANALYSIS FOR ELASTIC SCATTERING OF DEUTRONS AND ALPHA PARTICLES

Mark Reeves, III (Ph.D. Thesis – Tenn. Univ., Knoxville) 6 Jul. 1970 118 p refs
(Contract W-7405-eng-26)
(CTC-32) Avail: NTIS

A model is presented for the elastic scattering of deuterons and alpha particles. The target is assumed to have collective states which are excited by nonspherical interactions with each nucleon of the projectile. Nonlocal potentials are derived, and the elastic-channel Schroedinger equations containing these potentials are solved numerically for Ni-58 target. Inelastic effects are included for both projectiles, but contributions from stripping and breakup appear only in the deuteron case. Discussion is presented to explore possible modifications which would bring the predictions of this model into closer agreement with experimental data. Author (NSA)

N71-10754# Illinois Univ., Urbana. Dept. of Physics.

SYSTEMATICS OF ELASTIC SCATTERING

Lorella M. Jones and D. G. Ravenhall [1970] 25 p refs
(Grants NSF GP-19433; NSF GP-13671)
Avail: Issuing Activity

A simplification of the crossing matrix for elastic scattering is pointed out. New amplitudes, with particularly simple properties under parity and time reversal, are defined. These are useful in theories where the quantity of interest is the amount of direct channel helicity flip or sum. Author

N71-10755# Illinois Univ., Urbana. Dept. of Physics.

PATTERNS IN DIRECT CHANNEL HELICITY AMPLITUDES CAUSED BY CROSSED CHANNEL EXCHANGES

Lorella M. Jones and D. G. Ravenhall [1970] 32 p refs
(Grants NSF GP-19433; NSF GP-13671)
Avail: Issuing Activity

A set of patterns for regge exchanges in elastic scattering is discussed. Each pattern corresponds to a particular set of t channel quantum numbers, and allows only certain s channel helicity amplitudes to be present to order s sup alpha. Any regge residue may be constructed as a linear combination of the basic – patterns; any regge residue which vanishes sufficiently rapidly at t = 0 may be constructed as a linear combination of the basic + patterns. Correct behavior for both s and t channel amplitudes at t = 0 and t channel thresholds is ensured by the formalism. Author

N71-10757# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

TIGHT-BINDING ENERGY BANDS OF PEROVSKITE TYPE TRANSITION METAL OXIDES

Harutun George Karian (Ph.D. Thesis) Nov. 1969 264 p refs
(Contract W-7405-eng-82)
(IS-T-371) Avail: NTIS

The LCAO procedure for energy band calculations and the tight binding method, were applied to a series of perovskite transition metal oxides. An overlap criterion is used to limit the interaction set to nearest neighbor interactions. All two center integrals are evaluated explicitly using Schmidt orthogonalized linear combinations of Slater type orbital functions fitted to numerical SCF functions. The crystal potential is taken as a linear combination of atomic potentials and is varied by a SCF-MO-LCAO procedure based upon the Mulliken population analysis of Bloch sums over all wave vector or k space. Orbital energies are evaluated using the atomic orbital functions. The density of states, joint density of states, and results of the Mulliken population analysis are presented. Author

N71-10789*# Oak Ridge National Lab., Tenn. Neutron Physics Div.

CALCULATION OF THE PHOTON-PRODUCTION SPECTRUM FROM PROTON-NUCLEUS COLLISIONS IN THE ENERGY RANGE 15 TO 150 MeV AND COMPARISON WITH EXPERIMENT

Y. Shima and R. G. Alsmiller, Jr. 20 Nov. 1969 34 p refs Submitted for publication
(NASA Order H-38280A)
(NASA-CR-111121; PB-190182; ORNL-TM-2908) Avail: NTIS CSCL 20H

Calculations of the differential photon production cross sections from proton nucleus collisions in the energy range 15 to 150 MeV were carried out and compared with experimental measurements on 12C, 16O, 27Al, and 56Fe. The calculations are based on the intranuclear cascade evaporation model of nuclear reactions and simple assumptions about the deexcitation of excited nuclei. The calculated total photon production cross sections are within roughly a factor of two of the experimental values, but the calculated photon spectra are not in good agreement with the experimental spectra. Author (USGRDR)

N71-10790# National Bureau of Standards, Washington, D.C. Center for Radiation Research.

TECHNICAL HIGHLIGHTS, FISCAL YEAR 1969

1970 15 p refs
Avail: Issuing Activity

The center develops improved techniques and instruments for detecting and measuring ionizing radiation, obtains basic data on the interactions of radiation with matter, and investigates the structure of the various forms of matter. The center also maintains radiation sources and standards for providing national services essential to industrial, medical, and research applications. Radiation of concern to the center is that with energies between approximately 5 keV and 300 MeV, produced by radionuclides, reactors, and particle accelerators. Author

N71-10793# Stresau (R.) Lab., Inc., Spooner, Wis.

A STUDY OF SOME ASPECTS OF THE BEHAVIOR OF HEXANITROSTILBENE (HNS) IN SMALL CHARGES

R. H. Stresau May 1970 42 p refs Prepared for Sandia Corp.
(SC-CR-70-6076) Avail: NTIS

Determinations were made of sensitivity to initiation by small sources and detonation velocity in small column diameters as these properties are affected by loading density and of the relationship between loading pressure and loading density of two samples of hexanitrostilbene. For the two donor sizes used in the

gap tests (0.033-inch diameter and 0.064-inch diameter), the effect of loading density upon gap sensitivity of HNS-1A was rather small. For the smaller (0.033 diameter) donor the HNS-2A was most sensitive at a density close to 1.6 gms/cc and was significantly less sensitive at both higher and lower densities. For the larger donor (like HNS-1) the effect of density on gap sensitivity was quite small. In the detonation velocity measurements, the smaller (0.052-inch diameter) columns of HNS-2A had a significantly and systematically lower detonation velocity than in the larger (0.105-inch diameter) column. When these data were extrepolated to the ideal detonation velocity, the ideal detonation velocity density relationship was found to be very close to that of HNS1A.
Author

N71-10803# Los Alamos Scientific Lab., N.Mex.
BETA AND GAMMA BAND SYSTEMS OF NITRIC OXIDE
R. Engleman, Jr., P. E. Rouse, H. M. Peek, and V. D. Baiamonte Oct. 1969 37 p refs
(Contract W-7405-eng-36)
(LA-4364) Avail: NTIS

The ultraviolet beta and gamma band systems of nitric oxide were photographed at high resolution following the flash photolysis of nitrosyl chloride in excess argon. Between 2700 and 3100 A, 17 bands of the NO gamma system and 11 bands of the NO beta system were found and analyzed. Molecular constants were derived for v = 0, 1, ..., 16 of the X(2)pi ground state, and v prime = 0, 1, ..., 5 for both the A(2) sigma and the B(2)pi excited states. In addition, the (0,0) gamma, (1,0) gamma, and two isotopes bands were observed and analyzed from absorption spectra of NO gas.
Author (NSA)

N71-10833# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
USER'S MANUAL FOR THE DOT-2W DISCRETE ORDINATES TRANSPORT COMPUTER CODE
R. G. Soltesz, R. K. Disney, and G. Collier Dec. 1969 162 p refs
(WANL-TME-1982) Avail: NTIS

The WANL version of the DOT computer code for solving the two-dimensional, energy-dependent, linear Boltzmann transport equation with general anisotropic scattering is described. The major improvements of the DOT-2W code over the DOT code are the inclusion of acceleration techniques on the group flux solution, improved convergence logic, asymmetric quadrature capability, and improved tape operations. Detailed user information involving problem setup, running time, quadrature data and mesh spacing requirements is described. In addition, requirements for eigenvalue, fixed volume distributed source, boundary source, and search calculations are given. Typical problem setup information is supplied as well as a description of the printed output. A sample problem card input and printout are included.
Author (NSA)

N71-10842# Texas Univ., Austin. Electronics Research Center.
TABLES OF SCATTERING AMPLITUDES AND SPIN POLARIZATIONS OF 25, 50, 75, 150, 175, 200, 300, 400, 600, 800 eV ELECTRONS SCATTERED ELASTICALLY FROM H, He, C, Ne, Ar, Kr, Rb, Xe, Cs, Au, Hg, Pb, AND Bi-I
Manfred Fink and Albert C. Yates (Indiana Univ., Bloomington) 15 May 1970 159 p refs
(Grant AF-AFOSR-1792-69)
(AD-711664; TR-68; AFOSR-70-1652TR) Avail: NTIS CSCL 20/8

In order to investigate the influence of the spin in elastic low energy electron scattering from gaseous atoms, the Dirac equation was solved numerically. The complex scattering amplitudes, which describe the scattering process, are given. From the Tables it is possible to determine the elastic differential cross section, the spin polarization of elastic scattered electrons, the asymmetry of scattered electrons when the incoming electrons are already polarized, the change of the polarization vector in a scattering experiment a.o. The employed scattering potentials are relativistic Hartree potentials. The exchange of the electrons was not included since it contributes only very little, with the exception of the smallest angles. In this angular range the uncertainty in the wave functions for very large impact parameter is so significant that the addition of the approximation exchange would have distorted the values even further. Thus the scattering factors for Theta < 10 degrees have to be used with special care.
Author (TAB)

N71-10850# Oak Ridge National Lab., Tenn.
REPORT TO THE AEC NUCLEAR CROSS SECTION ADVISORY COMMITTEE
J. H. Gibbons May 1970 24 p refs Sponsored in part by AEC
(ORNL-TM-2998) Avail: NTIS

Brief reports are given on recent work at ORNL and on papers either published or submitted for publication during the last 6 months which are pertinent to the interests of the NCSAC.
Author (NSA)

N71-10855# Washington Univ., Seattle. Dept. of Physics.
GAMMA TRANSITIONS FROM HIGH SPIN STATES IN THE BETA VIBRATIONAL BAND OF Gd-154
S. M. Ferguson, R. Heffner, and H. Ejiri [1969] 20 p refs Supported in part by AEC
(RLO-1388-120) Avail: NTIS

The rotational levels with spins up to 10(+) in the beta-vibrational band of Gd-154 were excited by the Sm-154 (alpha, 4 neutrons gamma) Gd-154 reaction. The intraband gamma transitions between the beta-band levels and the interband gamma transitions from the beta-band levels to the groundband levels were measured with a Ge(Li) detector. The M1 components in the interband transitions between states with the same spin were deduced from the angular distributions. The ratios of E2 matrix elements of the interband to intraband transitions were obtained from the relative intensities of the observed lines. The general features of the transition-matrix elements were discussed in terms of a collective model with the rotation-vibration interaction.
Author (NSA)

N71-10868# Melbourne Univ., Parkville (Australia). School of Physics.
BETATRON AND AUXILLARY EQUIPMENT Final Report, 1 Aug. 1969 - 31 Jul. 1970
B. M. Spicer 31 Jul. 1970 21 p
(Contract DAHC19-69-G-0025)
(AD-710401) Avail: NTIS CSCL 20/8

The report discusses precision measurements of (gamma, neutron) cross sections, measurements of (gamma, protons) cross sections, the electric quadrupole giant resonance, photoproton energy and angular distributions, electron beam experiments, and photoneutron spectra from light nuclei.
Author (TAB)

N71-10897# California Univ., La Jolla. Dept. of Chemistry.
COLLINEAR COLLISIONS OF AN ATOM AND HARMONIC OSCILLATOR
Fred E. Heidrich, Kent R. Wilson, and Donald Rapp (Tex. Univ., Dallas) 14 Aug. 1970 43 p refs Submitted for publication Supported in part by NIH and NSF
(Contract N00014-69-A-0200-6)
(AD-711107; ONR-103) Avail: NTIS CSCL 20/10

A comparison is made between quantum, semiclassical, and classical treatments of collinear collisions, with exponential repulsive potential, between an atom and a harmonic oscillator. The quantum calculations used for comparison are those of Secrest and Johnson. The semiclassical treatment called ITFITS gives analytic transition probabilities in the form of a quantum forced-oscillator whose energy transfer is determined separately for each combination

of initial and final states by a refined impulsive classical approximation symmeterized over initial and final states. Detailed balance is obeyed. The classical treatment is phase-averaged; the energy transfer, calculated by numerical integration of the equations of motion, being averaged over the initial phase of the oscillator. It was concluded that, over the whole range of the quantum data, a semiclassical analysis is quite reasonable for transition probabilities and that both semiclassical and classical treatments give an essentially accurate description of average energy partitioning. Author (TAB)

N71-10904# Naval Academy, Annapolis, Md.
A NUMERICAL INVESTIGATION OF THE DEUTERON GROUND STATE
Philip T. Cahill 15 May 1970 74 p refs
(AD-711285; USNA-TSPR-6) Avail: NTIS CSCL 20/8

Schrodingers equation is used to compute the energy depth and range parameters used in various forms for the potential experienced by the two nucleons of the deuteron in its ground state. Analytic expressions for the wave function, effective range, scattering length, and root-mean-square radius for that system under the influence of a spherical square well are determined. For the more complex cases of potentials with exponential forms in them (excluding the cut-off exponential), analytic solutions are not so readily attainable; accordingly, a numerical scheme involving the Numerov iteration technique, a Runge-Kutta method particularly useful for second-order differential equations lacking first order terms and suggested by Raynal, was set up and programmed for use on the COMNET computer system using BASIC as the primary language. Parameters for various potentials were calculated and, as a result a new picture of the nucleus developed. While a complete search scheme for these parameters could not be formed, three programs were written which can, with a minimum of assistance from the programmer, determine the parameters for potential forms involving four arbitrary constants. Among the criteria they use are the values of the binding energy, scattering length, effective range, and root-mean-square radius. Author (TAB)

N71-10916# Florida Univ., Gainesville. Dept. of Physics and Astronomy.
MESON THEORETICAL POTENTIALS FOR USE IN ADVANCED POWER SUPPLY SYSTEM Final Report
A. E. S. Green 18 Aug. 1970 13 p refs
(Grant AF-AFOSR-1397-68)
(AD-711092; AFOSR-70-2269TR) Avail: NTIS CSCL 20/8

A way was found to reinterpret the super-positions of Yukawa functions arising out of a generalized field theory in terms of nuclear meson form factors. A GOBEP model involving only real identified mesons was developed. In particular, a broad mass scalar meson was included which may realistically describe the properties of the Pion negative pion S wave resonance. The resulting interaction is the most realistic description of the N-N interaction now in the literature. Attempts to extend the generalized GOBEP using a relativistic dynamic formalism were successfully completed using an adaption of the Bethe-Salpeter equation. TAB

N71-10919# Denver Univ., Colo. Dept. of Chemistry.
A STUDY OF THE KINETIC ENERGY OF IONIC PRODUCTS FROM ELECTRON IMPACT DISSOCIATION OF MOLECULES Final Report
Albert I. Ossinger and Eugene R. Weiner Jul. 1970 13 p refs
(Grant AF-AFOSR-1380-68)
(AD-711090; AFOSR-70-2268TR) Avail: NTIS CSLC 7/4

The purpose of the study of gas phase reactions among ions and molecules, such as occur in radiation chemistry, plasmas and upper and lower atmosphere chemistry, was to clarify the energetics of the simplest reaction steps. The kinetic energy determinations have been among the most difficult, largely because they are not directly observable by spectroscopic techniques. An attempt was made to devise a method for the direct measurement of the kinetic energies of the ionic products resulting from electron impact dissociation of molecules in a mass spectrometer. A time-of-flight mass spectrometer was modified to be entirely free of magnetic fields and to have a linear electric potential gradient along the flight axis. The ion beam profile measurements of methyl ions from propane and from 1-butene show a structure which indicates that dissociation occurs from several different excited states, each of which gives methyl ions with characteristic kinetic energies. Author (TAB)

N71-10924# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SEMIANNUAL REPORT OF THE CHEMISTRY DEPARTMENT NO. 7, DECEMBER 1968–MAY 1969 [RAPPORT SEMESTRIEL DU DEPARTEMENT DE CHIMIE NO. 7, DECEMBRE 1968–MAI 1969]
Feb. 1970 434 p refs In FRENCH
(CEA-N-1241) Avail: AEC Depository Libraries

A continuing program in chemical research is reported and includes: (1) methodology developments in chemical and electrochemical analysis; (2) methods for the concentration and decontamination of low-activity effluents; (3) techniques for recovery and treatment of uranium; (4) laboratory methods for aqueous and nonaqueous reprocessing; (5) preparation and study of actinide elements; (6) vitrification of fission product solutions; (7) corrosion behavior of steels and Fe-Cr-Ni alloys exposed to water vapor; (8) electrochemistry of fused salts and electrocrystallization; (9) salting out of neutral molecules in salt water mixtures; (10) extraction of hydrochloric acid and water by trioctylamine; and (11) spectrophotometry of neptunium in nitric acid medium. D.L.G.

N71-10935# Iowa State Univ. of Science and Technology, Ames.
INVESTIGATION OF ISOBARIC SPIN SPLITTING IN THE GIANT RESONANCE OF Zn-64
Frederick Herold Schamber (Ph.D. Thesis) Feb. 1970 188 p refs
(Contract W-7405-eng-82)
(IS-T-351) Avail: NTIS

Relative cross sections for the reactions Zn-64(gamma,n)Zn-63, Zn-64(gamma,np)Cu-62, and Zn-64(gamma,2n)Zn-62 were simultaneously measured using 10 to 40-MeV bremsstrahlung. The positron activities were detected by coincident gamma rays, and the three activities were separated by half-life. The (gamma,np) cross section is seen to be split into a strong and distinct resonance at 25 MeV and a broad component which rises on the trailing edge of the dominant resonance. The 25-MeV (gamma,np) peak is very similar in shape to the (gamma,n) resonance centered at 17.5 MeV and is about 20% of the (gamma,n) amplitude. The (gamma,2n) cross section is also at maximum near 25 MeV but is less than 1/3 of the (gamma,np) amplitude; thus, the large (gamma,np) strength is apparently not statistical in origin. The (gamma,np) resonance is identified with the isospin component of the giant resonance. Author (NSA)

N71-10939# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
DIFFICULTY AND POSSIBILITY OF KINETIC THEORY OF QUANTUM-MECHANICAL SYSTEMS. PART 3: INCONSISTENT SCALE EFFECTS IN THE THEORY OF SCATTERING. PART 4: INCONSISTENCIES IN REPRESENTATION OF PHOTON-ELECTRON INTERACTION
Toyoki Koga Jul. 1970 39 p refs
(Contracts Nonr-839(38); DAHC04-69-C-0077; ARPA Order 529; ARPA Order 1442)
(AD-711681; PIBAL-70-35-Pt-3-4) Avail: NTIS CSCL 20/10

It is shown that results of the theory of scattering among unfixed particles vary inconsistently as depending on the choice of

volume scale employed for the second quantization. This situation demonstrates that the conventional quantization method is not feasible for treating interactions among unfixed particles. The paradox is an inevitable consequence of the theory of absolute indeterminism underlying the conventional method of quantization. Only by interpreting a wave function as an ensemble representation may one reach reasonable results. It is noted that the same paradox arises in common in classical mechanics, if one treats interactions among particles according to Gibbs concept of particle. Inconsistent scale effects and questionable momentum relations are shown to be involved in conventional representatives of photonelectron interaction. The inconsistencies are similar to those which tend to occur in the classical kinetic theory. Author (TAB)

N71-10945# State Univ. of New York, Stony Brook. Inst. for Theoretical Physics.

LANDAU, BRUECKNER-BETHE AND MIGDAL THEORIES OF FERMI SYSTEMS

G. E. Brown (Nord. Inst. Teoretisk Atomfysik) [1969] 65 p refs (Contract AT(30-1)-4032)
(NYO-4032-23) Avail: NTIS

The Landau theory for infinite Fermi systems is discussed, and it is then shown how one can apply the Landau technique of functional differentiation of the energy with respect to quasiparticle occupation numbers in order to obtain the effective interaction, beginning from the Brueckner–Bethe approximation to the energy. Calculations of this effective interaction by Backman from a nucleon-nucleon potential are discussed and criticized. Results of his calculation are compared with parameters in Migdal's effective force, evaluated at the center of the nucleus, the latter parameters having been derived phenomenologically by fitting various nuclear phenomena. There is a large discrepancy between the calculated value of the compressibility of nuclear matter and that obtained phenomenologically. The advantages of introducing a model space in order to improve the accuracy of the calculated results is discussed. Author (NSA)

N71-10959# Kent Univ., Canterbury (England). Mathematical Inst.

THEORY AND APPLICATIONS OF PADE APPROXIMANTS AND QUANTUM FIELD THEORY Final Scientific Report, Oct. 1968–Jun. 1970

J. S. R. Chisholm 29 Jul. 1970 15 p refs (Grant EOOAR-69-0046)
(AD-711404; AFOSR-70-2346TR) Avail: NTIS CSCL 20/10

Preliminary investigations of the application of the Pade technique to sequences of approximants to single-variable integrals show that existing integration methods can be improved upon, particularly when the integrands are singular or are infinitely oscillating. Series of derivatives of delta-functions have been investigated (a) term-by-term as a generalised function and (b) by forming Pade Approximants of the Fourier transformed series. When the latter series is a series of Stieltjes, convergence of the approximants in interpretation (b) is established, to the generalised function defined by interpretation (a). Study has begun on solving linear integral equations of the form f = g + lambda Kf by forming the Pade approximant of the Neumann series. The method appears to work, but is dependent upon the accuracy of performing multiple integrals, which is to be studied under (a) above. Simple algorithms have been established which enable easy extraction of magnetic moment contributions from vertex parts in field theory. Author (TAB)

N71-10980# Oak Ridge National Lab., Tenn. Neutron Physics Div.

SULFUR NEUTRON ELASTIC AND INELASTIC-SCATTERING CROSS SECTIONS FROM 4.0 TO 8.5 MeV

F. G. Perey and W. E. Kinney Jun. 1970 51 p refs Sponsored in part by AEC (Contract W-7405-eng-26)
(ORNL-4539) Avail: NTIS

Numerical values are given for neutron elastic- and inelastic-scattering cross sections from sulfur in the range 4.0 to 8.5 MeV. A brief description of the experimental and data-reducing techniques is presented to assist in the evaluation of the data. The data are in general agreement with other data in this energy region. Author (NSA)

N71-10981*# Oak Ridge National Lab., Tenn.

APPROXIMATE DENSITY-EFFECT CORRECTION FOR THE IONIZATION LOSS OF CHARGED PARTICLES

T. W. Armstrong and R. G. Alsmiller, Jr. 12 Jan. 1970 11 p refs Submitted for publication
(NASA Order H-38280A; Contract W-7405-eng-26)
(NASA-CR-111032; ORNL-TM-2868) Avail: NTIS CSCL 20H

An approximate density-effect correction for determining the stopping power and range of high-energy charged particles is discussed and evaluated. For a variety of materials and all particle energies, use of the approximate density-effect correction, which can be easily computed for both elements and compounds, overestimates the stopping power by approximately < 6% and underestimates the range by approximately < 4%. This error should be acceptable in many practical problems that involve materials for which the correct density effect has not been evaluated. Author (NSA)

N71-10999*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COULOMB CORRECTIONS TO THE BETHE-HEITLER CROSS SECTIONS FOR ELECTRON-NUCLEUS BREMSSTRAHLUNG

S. H. Morgan, Jr. Washington Oct. 1970 104 p refs
(NASA-TN-D-6038; M-436) Avail: NTIS CSCL 20H

The bremsstrahlung differential cross section is obtained using both the Born approximation and a partial wave expansion. The cross sections are evaluated for energies in the 0.2 and 2.0 MeV range and compared with the experimental results for different scattering media. A comparison is made between the two theoretical approaches to obtain a correction to the Born approximation. The corrected Born approximation gives relatively good results in the 0.1 to 2.0 MeV range but is not applicable to higher energies. Author

N71-11000*# Columbia Univ., New York. Astrophysics Lab.

PROPERTIES OF SIMPLE ATOMS AND IONS Semiannual Reports No. 13, 14, and 15 and Quarterly Report No. 16, 1 Jan. 1969–30 Sep. 1970

R. Novick 1970 101 p refs
(Grant NGR-33-008-009)
(NASA-CR-111353; SAR-13; SAR-14; SAR-15; QR-16) Avail: NTIS CSCL 20H

Individual research projects of a continuing program are reported and include (1) total excitation cross sections for the 2 1p state of He in low-energy He(+)-He collisions; (2) experimental tests of the post-collision-interaction model for the He(+)-He excitation functions; (3) lifetimes and fine structure of the metastable autoionizing states of the negative helium ion; (4) precision measurement of the fine structure and lifetimes of the metastable autoionizing states of He(−) and Li^0; and (5) spectrum of the two-photon emission from the metastable state of singly ionized helium. D.L.G.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-10024# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.

TIME-RESOLVED ENERGY DISTRIBUTION IN A STRIATING DISCHARGE Final Report

R. F. Weber and A. Garscadden May 1970 29 p refs

(AD-710597; ARL-70-0079) Avail: NTIS CSCL 20/9

Preliminary results are reported for time-resolved Langmuir probe measurements made in a striating neon discharge. The presence of large amplitude moving striations of frequencies of a few kHz required the use of a recently developed sample-and-hold diagnostic system for analysis. This system allows one to obtain digital probe current data with an accuracy greater than 0.3% and compatible with computer reduction. Numerical analysis of the data provides the second-derivative and also determines the electron energy distribution, having identified space potential from the second derivative. The measurements show that the distribution is non-Maxwellian; in particular, preceeding the peak of the light intensity fluctuation, there exists a high energy group of electrons. The relaxation of this group through the phase of the striation is demonstrated and examples of the dependence on other discharge parameters are given. Measurements were made for two wave types distinguished by their products E lambda where E is the longitudinal electric field and lambda the wavelength of the striation. Author (TAB)

N71-10058# Ohio State Univ., Research Foundation, Columbus.

PLASMA DIAGNOSTIC TECHNIQUES AND GENERATION Final Report, 3 Nov. 1968 - 3 Nov. 1969

Marion L. Pool Wright-Patterson AFB, Ohio AFFDL Jun. 1970 232 p refs

(Contract F33615-68-C-1096)

(AD-709944; AFFDL-TR-70-69) Avail: NTIS CSCL 20/9

The report includes a history of the FDCL arc head and its operation. It also describes a technique for starting a low pressure, positive voltage-current characteristic, DC arc by using two separate power sources, an AC starting driver and a DC operating power supply. A Langmuir probe and a microwave interferometer have been used to measure the electron density and temperature in a plane 30 cm from the anode exit of the engine. Author (TAB)

N71-10100*# Avco Corp., Wilmington, Mass. Systems Div.

HIGH POWER QUASI-STEADY MPD ACCELERATION Final Report

A. C. Malliaris, D. R. Libby, and R. R. John May 1970 72 p refs

(Contract NAS1-9298)

(NASA-CR-111785; AVSD-0506-70-CR) Avail: NTIS CSCL 20I

An investigation of ion-neutral coupling in plasma acceleration is presented. The acceleration of a partially ionized gas by electromagnetic means is considered. Velocities are determined by Doppler shift measurements of selected spectral lines. Results regarding two different situations are presented from experiments where two basically similar axisymmetric configurations operate under significantly different conditions. In the first case, a large disparity in ion-neutral velocities is observed. In the second case, the said disparity disappears and the common ion-neutral velocities are in good agreement with the center of mass velocity, as determined independently from measurements of motionally induced potentials in the flow. A satisfactory interpretation of the results is obtained when the calculated mean free path for momentum exchange is compared with a typical dimension of the electromagnetic acceleration region. The preparation of a high power quasi-steady MPD for repetitive operation in the laboratory is also given. Two topics receive particular consideration: (a) The generation of desirable mass flow pulses on a repetitive basis, and the diagnostics of such pulses by transient probing; and (b) The development of a reptitively operating shutter with exposure durations between a few hundred microseconds and a few milliseconds. Author

N71-10185# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

TURBULENT HEATING IN PLASMAS

Paul Koch 25 Apr. 1970 25 p refs

(Contract F61052-70-C-0014)

(AD-710318; UNICP-SR70; AFOSR-70-2095TR) Avail: NTIS CSCL 20/9

The results of a Lagrangian analysis of homogeneous plasma turbulence were used to justify the assumtion that trapped particle modes were instrumental in the turbulent heating of plasma, and a set of equations was derived which describes the behavior of individual waves of that type. In section 2 the usual probabilistic assumptions of homogeneous turbulence are applied to the basic equations of a Vlasov plasma. A simple mixing length approximation is used to achieve closure of the resulting set of equations. Section 3 contains some basic principles of Lagrangian plasma turbulence. In section 4 trapped particle modes are examined and the results of Bohm and Gross are extended so that the exact non-linear equations that govern them can be derived. Author (TAB)

N71-10237*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PAIRED COMPARISON TESTS OF THE RELATIVE SIGNAL DETECTED BY CAPACITIVE AND FLOATING LANGMUIR PROBES IN TURBULENT PLASMA FROM 0.2 TO 10 MHz

J. Reece Roth and Walter M. Krawczonek 7 Nov. 1970 25 p refs Presented at the 12th Ann. Meeting of the Div. of Plasma Phys. of the Am. Phys. Soc., Washington, D.C., 4-7 Nov. 1970

(NASA-TM-X-52914) Avail: NTIS CSCL 20I

Paired comparison measurements of the spectrum of electrostatic potential fluctuations in a steady-state, turbulent plasma confined in a magnetic mirror geometry were made with capacitive and floating Langmuir probes over the frequency range from 0.2 to 10.0 MHz. For the experimental conditions investigated no significant difference in the relative frequency response was observed below 4.0 MHz. At about this frequency, however, the signal detected by the floating Langmuir probe dropped off relative to that of the capacitive probe. The source resistance of the turbulent fluctuations sensed by the Langmuir probe was about 400 ohms. At higher frequencies, from 7.0 to 10.0 MHz, a signal was detected by the floating Langmuir probe that was not detected by the capacitive probe. Author

N71-10300# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

LOCAL POTENTIAL AND NONLINEAR STABILITY IN MAGNETOHYDRODYNAMICS

Franz Herrnegger 30 Apr. 1970 22 p refs

(Contract F61052-70-C-0014)

(AD-710319; UNICP-SR64; AFOSR-70-2099TR) Avail: NTIS CSCL 20/9

In the paper the concept of local potential has been enlarged to stability investigations in hydromagnetics. A variational formulation for the entropy production rate has been given. In this principle convective and dissipative terms appear which property is useful for numerical treatment of stability problems. The results are applied to the Benard problem. Author (TAB)

N71-10344# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Physics.

PROJECT CHALICE: SOME CONTRIBUTIONS TO PLASMA DIAGNOSTICS Special Report No. 2 on Plasma Physics

Jerome K. Percus, George J. Yevick, Robin J. Harvey, and Wayne Carr 1 Jun. 1970 51 p refs

(Contract AT(30-1)-2582)

(SIT-2582-33; SIT-252) Avail: NTIS

A fairly effective approach to measuring density and velocity profiles of plasmas is by using Thomson scattering of electromagnetic radiation by the mobile electrons. Standard methods

were used with nearly monochromatic and nearly unidirectional radiation. The effect of controlling the distributions of frequency and direction was investigated. A method for increasing the fringe-shift resolution of a two dimensional optical interferogram by more than an order of magnitude without loss of a spatial resolution is described. A Fabry-Perot cavity was used as an interferometer to increase the number of passes. The sharpened fringes were multiplied in number by using a multimode laser as a light source. Problems arising with the use of Thomson scattering for plasma diagnostics are discussed. Calculations and comments to help resolve these problems are given. J.A.M.

N71-10430*# California Inst. of Tech., Pasadena. Dept. of Physics.
LARGE AMPLITUDE ALFVEN WAVES IN THE INTERPLANETARY MEDIUM, 2
John Belcher and Leverett Davis, Jr. Oct. 1970 81 p refs
(Grant NGR-05-002-160)
(NASA-CR-110999) Avail: NTIS CSCL 03B

An extensive study of the dynamic nonshock properties of the microscale fluctuations in the interplanetary medium was made using plasma and magentic field data from Mariner 5. The observations show that (1) large amplitude, nonsinusoidal Alfven waves propagating outward from the sun with a broad wavelength range from 1000 to 5,000,000 km dominate the microscale structure at least 50 percent of the time; (2) the purest examples of the outwardly propagating Alfven waves occur in high velocity solar wind streams and on their trailing edges; (3) the largest amplitude Alfvenic fluctuations are found in the compression regions at the leading edges of high velocity streams where the velocity increases rapidly with time; (4) power spectra of the interplanetary magnetic field in the frequency range from 1/(107 min) to 1/(25.2 sec) have frequency dependencies of f(-1.5) to f(-2.2); and (5) the microscale magnetic field fluctuations have an average power anisotropy of 5:4:1 in an orthogonal coordinate system. Author

N71-10456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STREAM-TUBE ANALYSIS USED TO CALCULATE ELECTRON CONCENTRATION IN THE PRESENCE OF ACCELERATING AND EVAPORATING WATER DROPLETS
Charles J. Scheuyder, Jr. John S. Evans, and Dennis M. Bushnell Washington Nov. 1970 89 p refs
(NASA-TN-D-6007; L-6756) Avail: NTIS CSCL 20I

An analysis is presented for use in the determination of the electron concentration in a flowing plasma in the presence of accelerating and evaporating water droplets. For given input gas-flow properties and gas composition, the resulting computer program is used to calculate gas density, gas and droplet velocity, temperature of the gas, enthalpy, fraction of droplet evaporated, Mach number, and gas composition as a function of distance along a stream tube. Representative calculations for the injection of water into a stream tube flowing over a reentry vehicle traveling at a velocity of 5.4 km/sec (17,717 ft/sec) are given. Author

N71-10488# Aerospace Corp., San Bernardino, Calif.
SCATTERING FROM A CONDUCTING CYLINDER CLAD WITH AN ANISOTROPIC PLASMA Technical Report, Feb. 1969—Oct. 1969
James B. Fedele 20 Feb. 1970 123 p refs
(Contract F04701-70-C-0059)
(AD-710692; TR-0059(S6816-40)-1; SAMSO-TR-70-298) Avail: NTIS CSCL 20/9

The scattering of an electromagnetic wave from a conducting cylinder clad with an anisotropic plasma of arbitrary electron density is considered. Resonant behavior of the system is investigated. The resonant conditions are obtained, and damping of resonant scattering by finite size effects and collisional dissipation is studied. Rayleigh and Geometrical Optics limiting cases are derived and the approach of the plasma scattering to that from a metallic body for increasing plasma frequency (electron density) is obtained. A parametrization of the scattering behavior as a function of the pertinent parameters of the system is presented in graphical form and comparisons with the scattering from an unclad cylinder and from a planar conductor sheathed with a plasma are made. Author (TAB)

N71-10532# Naval Postgraduate School, Monterey, Calif.
CONSTRUCTION OF A THETA-PINCH FOR THE GENERATION OF SHOCK WAVES IN A NITROGEN PLASMA
Dennis Michael Budzik (M.S. Thesis) Jun. 1970 35 p refs
(AD-711003) Avail: NTIS CSCL 20/9

A Theta-Pinch device was constructed for the production of shock waves in a nitrogen plasma. The device consisted of six 7 microfarad capacitors in parallel, and a one turn coil through which the capacitors were discharged. The rise time of the current in the coil is one microsecond, and the stored energy in the capacitors is 13 kJ at 25 kV. The large perturbation of the plasma is expected to produce large amplitude Alfven waves which would propagate up the plasma column. Author (TAB)

N71-10542# Naval Postgraduate School, Monterey, Calif.
THE DYNAMICS OF A LASER PRODUCED HEAVY ION PLASMA
Lawrence Martin Schadegg (M.S. Thesis) Jun. 1970 57 p refs
(AD-710728) Avail: NTIS CSCL 20/9

To investigate the front of a laser produced plasma that is expanding in a homogeneous magnetic field a reliable method of positioning the target, monitoring the laser, and observing the properties of the expanding plasma had to be developed. Photodiodes and supporting circuitry were constructed to observe the laser interaction with the plasma, plasma expansion velocity, and total light emitted from the plasma. A heavy material, copper, was chosen to slow down the processes occurring in the expanding plasma front. The predictions of a computer program of the mathematical analogue to the experiment give expansion velocities of approximately 10 to the 6th power cm/sec and indicate a bouncing of the plasma front off the magnetic field. Author (TAB)

N71-10643# Naval Postgraduate School, Monterey, Calif.
INDUCTIVE MAGNETIC PROBE DIAGNOSTICS IN A PLASMA
Terrence Adrien McLaughlin (M.S. Thesis) Jun. 1970 51 refs
(AD-710734) Avail: NTIS CSCL 14/2

Inductive magnetic probes were studied, designed, constructed, calibrated and used at the Plasma Study Facility. The probes were built for three specific purposes: to measure current, radial shock waves and Alfven waves in a fast Theta Pinch; to measure the parameters of shock fronts with short rise times produced by laser exploding of metal fibers; and to observe instabilities in a steady state plasma. Theta Pinch current measurements gave a current of 110 KAmps with the Theta Pinch operating with the capacitors charged to 13KV of 25KV maximum. The ringing frequency of the Theta Pinch was measured as 179 KHz. On calibration, the shock front probes showed a first resonance at 40 MHz which is comparable to probe characteristics found in recent literature. The instability probes gave information which agreed with previous descriptions of instabilities based on optical and Langmuir probe diagnostics. Author (TAB)

N71-10655# California Univ., Berkeley. Coll. of Engineering.
DIAGNOSTIC STUDIES IN AN INDUCTION-HEATED SUPERSONIC ARGON PLASMA
Robert B. Fraser (Ph.D. Thesis) Jun. 1970 89 p refs
(Grant AF-AFOSR-0538-67)
(AD-711127; AS-70-5) Avail: NTIS CSCL 20/9

Diagnostic studies were carried out in an induction-heated low density supersonic plasma jet. The neutral number of densities were obtained from the calibrated intensity of the 4609A line of argon excited by a 25 kilovolt electron beam. The contribution to the 4609A line due to the plasma self-emission was found to be negligible. The velocities and heavy particle temperatures were determined by measuring the Doppler shift and Doppler-broadening of the 4609A line with a Fabry-Perot interferometer in two linearly independent directions, following a technique developed by Muntz. The density, impact pressure, and velocity along the free jet centerline all followed the isentropic source flow model up to the Mach disc. The temperature, however, showed an unexpected rise above the isentropic prediction. Ion number densities and electron temperatures were measured with a double Langmuir probe. The fraction of ionization was frozen at about 0.1% along the free jet axis. Calculations are made of the fraction of the energy of recombination absorbed by the electrons and the fraction lost by radiation. Author (TAB)

N71-10593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVERSE POPULATING OF ARGON LEVELS IN A SUPERSONIC PLASMA JET
V. M. Goldfarb et al 28 May 1970 11 p refs Transl. into ENGLISH from Uch. Zap. Gos. Pedagog. Inst. (Leningrad), v. 384, no. 2, 1968 p 122–128
(AD-711141; FTD-HT-23-237-70) Avail: NTIS CSCL 20/9

The supersonic Ar plasma jet was cooled by rapid expansion into vacuum. The inverse population of Ar levels and negative absorption coefficient were found spectrographically. This reveals the possibility of making a gas-dynamic laser. Author (TAB)

N71-10622# Columbia Univ., New York. Plasma Lab.
MAGNETIC STRUCTURE OF OBLIQUE AND NORMAL IONIZING SHOCK WAVES
B. P. Leonard Jul. 1970 68 p refs
(Contract AF 49(638)-1634)
(AD-711088; AFOSR-70-2284TR; Rept-50) Avail: NTIS CSCL 20/9

Oblique and normal ionizing shock waves are considered as a subclass of the skew shocks. It is shown explicitly that, for these cases, when the electrical conductivity is a scalar, the magnetic field and velocity vectors lie in a single plane throughout the shock structure. Details of the shock structure are given in the large-Ohmic-diffusion limit for a range of values of the upstream magnetic pressure ratio as the transverse electric field is varied parametrically. Author (TAB)

N71-10657*# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF ANTENNAS AND WAVES IN PLASMA Semiannual Status Report, 1 Mar.–31 Aug. 1970
1 Sep. 1970 4 p ref
(Grant NGR-22-007-056)
(NASA-CR-111138) Avail: NTIS CSCL 20I

The research in antennas and waves in plasmas is reported. Articles presented include: (1) linear antennas in lossy media, (2) theoretical and experimental studies on an antenna in a magnetoplasma, (3) antennas in isotropic plasmas, and (4) the finite cylindrical antenna in a warm, isotropic plasma. F.O.S

N71-10709# Los Alamos Scientific Lab., N.Mex.
COLLECTIVE INTERACTIONS AND PLASMA HEATING IN A HIGH-CURRENT GAS DISCHARGE
V. A. Suprunenko et al May 1970 8 p refs Transl. into ENGLISH from the Russian Report KHFTI-69-30
(LA-4382-TR; KHFTI-69-30) Avail: NTIS

Processes inducing kinetic instabilities and heating of dense plasma placed in a strong electric field were studied. Data obtained showed that effective heating of electron and ion plasma components took place in a high-current gas discharge during the development of high-frequency instabilities accompanied by anomalous plasma resistance and intense microwave emission. Results are discussed and the possibility of finding the mechanism inducing the instabilities was analyzed. Author (NSA)

N71-10739# Stanford Univ., Calif. Inst. for Plasma Research.
ELECTRON TEMPERATURE AND NUMBER DENSITY MEASUREMENTS IN A NONEQUILIBRIUM PLASMA BOUNDARY LAYER
Robert T. Brown Jan. 1970 257 p refs
(Contract F44620-68-C-0051)
(AD-711669; SU-IPR-350; AFOSR-70-2371TR) Avail: NTIS CSCL 20/9

Measurements of the electron temperature and electron number density in a nonequilibrium plasma boundary layer are presented along with related analyses. The plasma consisted of atmospheric pressure NaK seeded argon at 2400 degrees K flowing over a cooled flat surface which was electrically floating and non-emitting. The analyses proceed from consideration of the coupled electron continuity and electron energy equations with boundary conditions appropriate to NaK seeded argon. The entire electron continuity equation is retained, including the ionization-recombination source term. Various source terms are included in the electron energy equation to account for elastic collisions, inelastic collisions with seed atoms, and inelastic collisions with gas additives such as molecular nitrogen. The equations are transformed into boundary layer coordinates using a local similarity transformation and are solved numerically for a range of plasma conditions. It is shown that the major nonequilibrium effects can be interpreted in terms of three characteristic lengths: delta the thermal layer thickness, l sub E the characteristic length for electron energy exchange, and l sub I the characteristic length for ionization and recombination. Author (TAB)

N71-10890# Army Electronics Command, Fort Monmouth, N.J.
HIGH-ORDER PERTURBATION THEORY FOR A ONE-ELECTRON ION IMMERSED IN A PLASMA
Gerald J. Iafrate Jul. 1970 86 p refs
(AD-710950; ECOM-3305) Avail: NTIS CSCL 20/9

High order Rayleigh-Schrodinger perturbation theory is developed and applied to model problems in plasma spectroscopy; namely, the separate problems of an electron bound in a screened Coulomb potential and a one-election ion under the influence of long range proton. Author (TAB)

N71-10964*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIAGNOSTICS OF A SUPERSONIC PLASMA STREAM USING AN IMMERSED MICROWAVE PROBE
Frederic A. Baker, Masayuki Omura, and Austin H. Somes Washington Nov. 1970 19 p refs
(NASA-TM-X-2132; A-3624) Avail: NTIS CSCL 20I

A microwave interferometer to measure electron density and collision frequency profiles in a supersonic plasma jet is described. Unlike most plasma diagnostic interferometers, both the transmitting and receiving horns were immersed in the plasma stream. Advantages and disadvantages of the immersed horn technique are discussed. The measurements were made primarily by a 70 GHz system; another system operating at around 35 GHz was used to check the results at certain points. The measured densities ranged from 10 to the 12th power to 6 x 10 to the 13th power/cu cm, and the collision frequency was nominally 10 to the 10th power/sec. Despite the formation of shock waves around the horns, the measured densities compared well with the results obtained from a different microwave measuring technique which is described. Author

N71-10092# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF A LARGE SCALE NONEQUILIBRIUM MAGNETOHYDRODYNAMIC GENERATOR Annual Report, 1 Aug. 1969 – 31 Jul. 1970
B. Zauderer 31 Jul. 1970 15 p refs
(Contract Nonr-3867(00))
(AD-711351) Avail: NTIS CSCL 10/2

A large portion of the effort of the present contract year was devoted to technology problems, namely, the development of a satisfactory cesium seeding technique, the development of the thermionically emitting electrodes compatible with the shock tube MHD generator, the design of a large MHD magnet, the design of a new MHD channel, and the development of additional diagnostic techniques. A considerable number of MHD experiments with cesium seeded, noble gases were performed. An analytical study of power optimization in linear MHD generators was undertaken. A study of the effect of molecular gases on the generator performance was undertaken. TAB

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-10065# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 Feb. – 30 Apr. 1970
Allan L. McWhorter 21 Jul. 1970 92 p refs *Its* Ser. No. 2
(Contract AF 19(628)-5167)
(AD-711074; ESD-TR-70-148) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1970. The topics covered are Solid State Device Research, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (TAB)

N71-10088*# Pennsylvania State Univ., University Park. Materials Research Lab.
INVESTIGATION OF THE OPTICAL PROPERTIES OF SILICON SOLAR CELL COMPONENT MATERIALS Final Report
K. Vedam 5 Dec. 1969 16 p refs Prepared for JPL
(Contract NAS7-100; JPL-952385)
(NASA-CR-111004) Avail: NTIS CSCL 20L

Optical absorption coefficient of intrinsic silicon was determined at a number of discrete wavelengths in the spectral range 400-1000 nm at room temperature. These measurements were also extended to liquid nitrogen and liquid helium temperatures. Results of these measurements in conjunction with earlier measurements on the refractive index of silicon provide reliable data on the optical constants of intrinsic silicon and forms the basis for comparison with similar properties of doped and Li diffused silicon. Irradiation of silicon with 6 MeV protons to fluences of 10 to the 16th power particles/sq cm does not produce any noticeable change in its optical properties, as determined by techniques involving reflectivity, within the limits of experimental error. Author

N71-10082*# Pennsylvania State Univ., University Park. Materials Research Lab.
CHARACTERIZATION OF NON-LUMINESCENT, NEAR-INSULATING SOLIDS
H. K. Henisch and G. W. Fabel *In its* Space Appl. of Solid State Luminescent Phenomena 1970 p 56-60 refs Sponsored by AEC (See N71-10076 01-30)
Avail: NTIS CSCL 20L

Electret processes represent the most effective method for characterizing nonluminescent and near-insulating solids. These processes regard the material as a medium for polarized depth. The advantage of this method over others is that the measurement can be performed without conducting electrodes. Highly insulating layers of small thickness can be interposed between the material under test and the metal electrodes. A thermoelectret is formed by first heating and subsequently cooling the specimen in the presence of a moderately high electric field. The electrodes are temporarily short circuited and then allowed to float. Their potential difference is monitored during a subsequent heating process. An alternative procedure is to form the electret by illumination without heating. E.M.C.

N71-10085*# Pennsylvania State Univ., University Park. Materials Research Lab.
INTRINSIC CATHODOLUMINESCENCE EMISSION FROM WILLEMITE SINGLE CRYSTALS
R. J. R. S. B. Bhalla *In its* Space Appl of Solid State Luminescent Phenomena 1970 p 71-78 refs (See N71-10076 01-30)
(Contract DA-49-083-OSA-3140)
Avail: NTIS CSCL 20L

Intrinsic cathodoluminescence emission from oriented willemite (Zn_2SiO_4) single crystals was studied using an electron microprobe. Natural willemite crystals free of manganese and iron impurities were used. The emission was found to be strongly polarized for the crystals oriented such that the c-axis was in the surface. The electric vector of emission was along the c-axis and the degree of polarization was 0.75. Crystals with orientation such that the c-axis was perpendicular to the surface did not show any polarization. Author

N71-10113*# Kentucky Univ., Lexington. Coll. of Engineering.
RESEARCH STUDY OF STRUCTURAL DAMAGE PRODUCED IN SILICON SEMICONDUCTORS BY NEUTRON IRRADIATION Semiannual Report
Gordon A. Sargent 1969 21 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952561)
(NASA-CR-111031- PB-190296) Avail: NTIS CSCL 20L

The main objectives are to attempt to determine the size, distribution, morphology, and structural characteristics of the regions of lattice disorder which are produced by bombarding lithium doped silicon solar cells with neutrons. The effects of annealing the cells after irradiation was also studied. The experimental work is being carried out on the electron microscope using surface replication and thin film transmission techniques. Etching techniques for preparing the surfaces of the samples for the electron microscopy were developed. It was observed that in the lithium doped cells, the lithium is present as a precipitate particle, thus more lithium may be present in the cells than was determined by the usual resistivity measurements. Author

N71-10127# Royal Radar Establishment, Malvern (England).
LARGE OXIDE SINGLE CRYSTALS
D. B. Gasson and B. Cockayne *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-10126 01-34)
Copyright. Avail: NTIS

The problems associated with the work chamber for preparing crystals up to 2.5 cm in diameter and 15 cm in length are briefly described. The chamber is fitted to the standard equipment for Czochralski pulling from the melt. The principal problems arise with thermal insulation for the iridium crucibles which are heated near to their melting point. Secondary problems include attachment of the seed to the pulling mechanism, choice of materials to withstand extreme environments, and provision of a suitable viewing aperture. N.E.N.

N71-10128# Royal Radar Establishment, Malvern (England).
THE MEASUREMENT OF CONCENTRATION CHANGES ACROSS STRIAE
E. M. Dodson *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p (See N71-10126 01-34)
Copyright. Avail: NTIS

A microetch technique is described for removing very thin layers of highly refractory single crystal oxides parallel to the striae. The area of specimen surface is about 0.25 sq cm and the depth is between 0.01 and 0.05 mm, yielding volumes of water-soluable solution which can be analyzed by ultramicro colorimetric or mass spectrometric techniques. N.E.N.

N71-10129# Royal Radar Establishment, Malvern (England).
A NEW TECHNIQUE FOR STUDYING THE ORIENTATION AND PERFECTION OF SINGLE CRYSTAL SAMPLES IN THE SCANNING ELECTRON MICROSCOPE
D. G. Coates *In its* RRE Newsletter and Res. Rev., No. 8 1969 4 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

An effect which permits certain diffraction type studies to be carried out in conducting and semiconducting bulk samples by scanning electron microscopy, and the specific microscope techniques are described. The effect is in the form of orientation dependent lines and bands of contrast, and is explained in terms of anomalous absorption or electron channelling. The equipment and adjustments to produce optimum resolution are mentioned. N.E.N.

N71-10130# Royal Radar Establishment, Malvern (England).
EPITAXIAL GROWTH OF FERRITES FROM THE VAPOUR BY CHEMICAL TRANSPORT
D. J. Marshall *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The chemical transport apparatus was constructed of fused silica, with an easily replaceable liner tube. The source material consisted of pure oxides hydrostatically pressed into rods 5 mm in diameter. The seed was a slice of single crystal 10-15 mm square and 1-2 mm thick. The best epitaxial growth of ferrite was obtained between 800-850 C, using oxygen saturated with water vapor. Most of the preparation involved nickel ferrite growth on various surfaces of magnesium oxide, and the results under different conditions are mentioned. N.E.N.

N71-10131# Royal Radar Establishment, Malvern (England).
INDIUM GALLIUM PHOSPHIDE: A NEW ELECTROLUMINESCENT SEMICONDUCTOR
C. Hilsum *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Difficulties in obtaining semiconductor lamp materials with an energy gap of 2 eV are reviewed, and preliminary results using indium gallium phosphide are described. It was found that epitaxial layers covering the range from InP to GaP can be made in an indium gallium solution using an InP substrate. Initial measurements of the direct and indirect transistions in the two phosphides indicate that it should be possible to make an alloy with a direct energy gap of 2.1 eV. N.E.N.

N71-10132# Royal Radar Establishment, Malvern (England).
INETICS OF NUCLEATION ON A SURFACE
R. M. Logan *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

A microscopic description of nucleation in crystal growth is provided by a set of equations giving the rate of change with time of the number density of clusters containing i atoms (i = 1,..., infinity) on any element of area of the surface. The rate equations are reduced to a pair of coupled differential equations, yielding numerical results for the time development of the dimensionless number density of single atoms and the dimensionless number density of stable nuclei of all sizes. The rate equations also lead to a realistic saturation point. N.E.N.

N71-10134# Royal Radar Establishment, Malvern (England).
PSEUDOPOTENTIAL CALCULATIONS OF THE BAND STRUCTURE OF GaAs, InAs AND (GaIn)As ALLOYS
D. Jones and A. H. Lettington *In its* RRE Newsletter and Res. Rev., No. 8 1969 5 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The method of calculation is outlined, and the theoretically determined values of the band gap are found to compare well with experimental data. Graphs are given of the band structure of GaAs and the variation of two band gaps with InAs-GaAs alloy concentration. It is concluded that a fundamental model is capable of giving useful results for simple materials. N.E.N.

N71-10135# Royal Radar Establishment, Malvern (England).
THE CALCULATION OF DISTRIBUTION FUNCTIONS, 1
W. Fawcett and H. D. Rees *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-101126 01-34)
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Two numerical methods for calculating distribution functions for electron transport in semiconductors are reported. The first method uses a Monte Carlo technique and the other uses a numerical integration to simulate the motion of a single electron under alternating accelerating and scattering fields. N.E.N.

N71-10136# Royal Radar Establishment, Malvern (England).
THE CALCULATION OF DISTRIBUTION FUNCTIONS, 2
W. Fawcett and H. D. Rees *In its* RRE Newsletter and Res. Rev., No. 8 1969 5 p (See N71-10126 01-34)
Copyright. Avail: NTIS

The Monte Carlo and numerical integration methods are applied to the calculation of electron transport properties of n-type gallium arsenide and p-type germanium. These properties include time and frequency responses, and drift velocity. N.E.N.

N71-10139# Royal Radar Establishment, Malvern (England).
PLASMA WAVE PROPAGATION IN A PERIODIC STRUCTURE
A. C. Baynham and A. D. Boardman (Salford Univ.) *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-10126 01-34)
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Helicon propagation is discussed in a periodic structure produced by spatial modulation of the magnetic field, or plasma eclectron density. A computed dispersion relation for a periodic system composed of alternate metal and semiconductor layers is analyzed. It is concluded that synchronism can be achieved with the helicon space harmonics in a suitable periodic structure. F.O.S.

N71-10140# Royal Radar Establishment, Malvern (England).
A NON-LINEAR THEORY OF ACOUSTOELECTRIC GAIN AND CURRENT IN PIEZOELECTRIC SEMICONDUCTORS
N. R. Ogg and P. N. Butcher (Warwick Univ.) *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-10126 01-34)
Copyright. Avail: NTIS

The amplification of acoustic waves is studied in piezoelectric semiconductors by interaction with supersonic electrons drifted in an applied electric field. The results indicate that as the degree of bunching increases, the acoustic gain decreases and the current saturates, and the frequency at which peak gain occurs shifts to lower frequencies. F.O.S.

N71-10141# Royal Radar Establishment, Malvern (England).
OPTICAL ACTIVITY IN NON-ENANTIOMORPHOUS CRYSTALS
M. V. Hobden *In its* PRE Newsletter and Res. Rev., No. 8 1969 2 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

Optical activity is studied as a weak perturbation of the ordinary dispersive properties of a continuous medium. The optical properties crystals of AgGaS2 and CdGa2S4 are reported.
F.O.S.

N71-10143# Royal Radar Establishment, Malvern (England).
THE ELECTRICAL PROPERTIES OF PROUSTITE (AG3ASS3)
P. H. Davies, C. T. Elliott, and K. F. Hulme *In its* RRE Newsletter and Res. Rev., No. 8 1969 2 p (See N71-10126 01-34)
Copyright. Avail: NTIS

Proustite crystals were studied for mixing frequencies in the optical and infrared spectra, and for use of its piezoelectric and semiconducting properties. The electrical properties of single crystals are listed. It is concluded that ionic transport and dendrite propagation are of primary importance when electrical charge is passed through highly pure Proustite single crystals at room temperature.
F.O.S.

N71-10155# Royal Radar Establishment, Malvern (England).
FEASIBILITY STUDIES OF A 50 NANOSECOND CYCLE TIME THIN FERROMAGNETIC FILM STORE
J. D. R. McQuillin and J. R. Bosnell *In its* RRE Newsletter Res. Rev., No. 8 1969 4 p (See N71-10126 01-34)
Copyright. Avail: NTIS

A feasibility study of the planar ferromagnetic films with a view to constructing an economic store module has the following aims: (1) Optimization of the film and stack geometric parameter, (2) Optimization of the physical properties of the magnetic films with reference to drive requirements, output signals and magnetostatic stability criteria. Two thin film production techniques, triode sputtering and electron beam evaporation, have been employed.
Author

N71-10202# Royal Radar Establishment, Malvern (England).
PROGRESS TOWARDS THE GROWTH OF GOOD OPTICAL QUALITY BARIUM SODIUM NIOBATE
A. W. Vere, J. G. Rhint, and B. Cockayne *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

The growth and defect structure of barium sodium niobate as an efficient second harmonic generator are studied. Problems associated with the segregation effects during solidification are examined. The process of domain reversal under applied fields as required in the poling processes were impaired by growth striae. Striae also acted as twin nucleation sites.
J.A.M.

N71-10203# Royal Radar Establishment, Malvern (England).
ELECTRO-OPTICAL POLARIZATION SWITCHES FOR DIGITAL LIGHT DEFLECTION
K. F. Hulme, P. H. Davies, and V. M. Cound *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Certain niobates and tantalates were found to have large electro-optic coefficients and were considered for possible use in digital light deflectors. The longitudinal electro-optic effect in which electric field and light propagation directions coincide was observed. The predicted minimum drive voltages for longitudinal switches are given for several crystals, along with the directions in which they occur. Experimental studies using applied electric fields at 50 Hz and in the form of 2 microsecond long pulses were used to confirm the predicted minimum drive voltage of 2500V.
J.A.M.

N71-10204# Royal Radar Establishment, Malvern (England).
AUTOMATIC ELECTRICAL MEASUREMENTS ON SEMICONDUCTORS
C. T. Elliott and D. J. Wilson *In its* RRE Newsletter and Res. Rev., No. 9 1970 5 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

New semiconducting materials were assessed by electrical resistivity and Hall coefficient measurements over a wide range of temperatures. Electronic equipment operating from 4 to 400 deg K in a single run is described. The sample form used for measurement and data acquisition systems is shown schematically. The potential differences between the probes on the sample are measured for both directions of sample current and magnetic field.
J.A.M.

N71-10211# Royal Radar Establishment, Malvern (England).
ASSESSING INDIUM GALLIUM PHOSPHIDE
A. M. White and E. W. Williams *In its* RRE Newsletter and Res. Rev., No. 9 1970 3 p (See N71-10201 01-34)
Copyright. Avail: NTIS

Indium gallium phosphide made by liquid epitaxy method in a tilt furnace was assessed. Compositions were determined by X-ray fluorescence measurements and were found to vary linearly with the lattice parameter. The simplest and most convenient way of estimating the performance of these alloy layers were found to be by photoluminescent experiments. A technique was adopted using the features of photoluminescent and absorption methods.
J.A.M.

N71-10212# Royal Radar Establishment, Malvern (England).
INDIUM ARSENIDE PHOSPHIDE, THE OPTIMUM SEMICONDUCTOR FOR MICROWAVE DEVICES
C. Hilsum and H. D. Rees *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Optimum microwave semiconductors using direct gap indium arsenide phosphide having low electron effective masses are examined. Parameters for the alloys were found by linear interpolation. A modified version of the Monte Carlo technique was used to calculate drift velocity. The modifications were made to include nonparabolicity and avalanching effects.
J.A.M.

N71-10213# Royal Radar Establishment, Malvern (England).
SCANNING ELECTRON MICROSCOPE STUDY OF TRANSVERSE TRANSFERRED ELECTRON DEVICES
C. O. Newton *In its* REE Newsletter and Res. Rev., No. 9 1970 3 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Research on the Gunn effect is reported, and emphasis is on the relation between device construction and electrical breakdown and on the electric field distribution in devices of nonuniform cross section. In the first area, scanning electron microscope studies showed significant differences in the nature of pulsed and CW breakdown and confirmed the role played ion migration from an evaporated metal anode. Micrographs are given illustrating the emissive mode and the photoconductive mode methods of observing electric field distributions, and their interpretation is described. Stroboscopic probing of domains in motion is also mentioned.
N.E.N.

N71-10214# Royal Radar Establishment, Malvern (England).
THE EVALUATION OF SEMICONDUCTORS USING THE IMPURITY PROFILE PLOTTER
D. J. Colliver and A. F. Fray *In its* RRE Newsletter and Res. Rev., No. 9 1970 4 p refs (See N71-10201 01-34)
Copyright. Avail: NTIS

Initial studies with the impurity profile plotter are described. The instrument gives a direct analog plot of the log of the impurity concentration versus the depth. Work was done with gallium

arsenide grown for Q band domain mode operation, and profiles of layers giving reasonable performance and those giving poor results are presented. N.E.N.

N71-10239*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SEARCH FOR A SUPERCONDUCTING EFFECT ON ALPHA PARTICLE DIFFERENTIAL ENERGY LOSS IN TYPE 1 SUPERCONDUCTORS
W. K. Roberts and D. C. Liu 25 Nov. 1970 8 p refs Presented at the Fall Meeting of the Am. Phys. Soc., New Orleans, 23-25 Nov. 1970
(NASA-TM-X-52896) Avail: NTIS CSCL 20L

The possibility of a superconductivity effect in the differential energy loss process of nonrelativistic charged particles were investigated. The mass and number of electrons for a specific charged particle traversing a particular superconductor in the superconducting and normal states are discussed based on the Bethe equation. An equation for the fractional difference in the differential energy loss due to a superconducting effect is derived and an experiment is outlined for the measurement of the magentic penetration depth of tin, vanadium, and lead foils in both states. The position of the maximum of each alpha particle group degradation peak in the superconducting foil was determined by computer least squares fitting of a sixth order polynomial to the experimental data of the upper half of each peak and then determining the point at which the differential of the polynomial equalled zero. Goodness of fit of tin degraded peak data and calculated differential curves of the polynomial are shown graphically. Summarized results show the dE/dx in the two states are equal to within plus or minus 0.15% for tin, vanadium, and lead which is not inconsistent with a null effect. J.M.

N71-10375# Ohio State Univ., Columbus. Dept. of Physics.
TRANSPORT PHENOMENA IN METALS AT LOW TEMPERATURES Final Report, 1 Jan. 1966–30 Jun. 1970
M. Yaqub Aug. 1970 10 p refs
(Grant AF-AFOSR-1051-66)
(AD-710851; AFOSR-70-2208TR) Avail: NTIS CSCL 20/12

Electrical conductivity of cylindrical single crystals of high purity gallium has been measured between 1.1 degrees K and 4.2 degrees K as a function of crystalline orientation and diameter using the highly sensitive superconducting interference galvanometer capable of detecting 10 to the -14th power volt. Electrical conductivity of the single crystal films of high purity gallium has been measured between 1.1 degrees K and 20 degrees K as a function of orientation and thickness. Thermal conductivity of cylindrical single crystals of gallium has been measured as a function of orientation and diameter for the three principal axes between 1.1 degrees K and 4.2 degrees K. The thermo emf of single crystals of gallium has also been measured as a function of orientation between 1.1 degrees K and 4.2 degrees K using the superconducting interference device. An apparatus for the measurement of Kapitza Boundary resistance by using a second sound resonating cavity has been built and successfully operated. A sub 3 He-sub 4 He dilution refrigerator for extending the work to lower temperatures (between 1 degrees K and .1 degrees K) has been constructed and is ready for preliminary testing. Author (TAB)

N71-10410*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF CORRELATION ON THE STRUCTURE OF IMPURITY BANDS
Gust Bambakidis Nov. 1970 16 p refs
(NASA-TN-D-6074) Avail: NTIS CSCL 20L

The effects of electron-electron interaction on the electronic density of states was considered for a dilute system of scattering centers distributed randomly in an electron gas of moderate density. Using as the starting point an independent electron t matrix method, a modified t matrix in the presence of the electron-electron interaction is obtained. To illustrate the effects of correlation, the formalism was applied to the simple case of a linear chain of attractive delta function potentials distributed randomly. The electrons are assumed to interact by means of a repulsive delta function potential. The density of states in the impurity band is evaluated and compared with the results for independent electrons. It is found that the inclusion of electron-electron interaction produces a significant broadening and downward energy shift of the impurity band. Author

N71-10493# Tyco Labs., Inc., Waltham, Mass
GALLIUM ARSENIDE Final Technical Report, 1 Mar.–31 May 1970
Naim Hemmat and Fritz Wald Aug. 1970 31 p refs
(Contract N00014-70-C-0259)
(AD-710812) Avail: NTIS CSCL 20/2

Because of its large band gap and high mobility, GaAs is widely used in a range of electronic and electro-optic devices. GaAs bulk crystals are produced primarily from melts using modifications of the Bridgman and Czochralski techniques. In this report, bulk crystal growth from solution is described and its advantages over other growth techniques are pointed out. In the course of the 3-month project reported here, feasibility of bulk crystal growth of GaAs from gallium-rich solution was clearly demonstrated. Four GaAs ingots up to 5 cm in length and 1 cm in diameter were produced, using the traveling heater method(THM). The preferential growth direction of GaAs for this type of growth was also determined. Due to the high cost of single crystal GaAs with suitable dimensions and orientations, seeding from single crystal seeds was not attempted. But in three experiments, growth from multigrain seeds was successfully demonstrated. The GaAs crystals grown by THM exhibited a relatively low concentration of impurities of the type generally detected in the materials prepared by other techniques. Dislocation densities in the order of 1000/sq. cm. were observed in a few of the grains for which the <111> direction coincided with the growth direction. Author (TAB)

N71-10505# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
MECHANICAL TWINNING OF TITANIUM SINGLE CRYSTALS Technical Report, Sep. 1968–May 1970
Shiro Fujishiro and Jeffrey W. Edington (Cambridge Univ. (England).) Jul. 1970 37 p refs
(AD-710899; AFML-TR-70-176) Avail: NTIS CSCL 20/2

Compression tests were performed on titanium single crystals at room temperature and at -196C, and the twinning mode was investigated using metallographic, electron microscopy and X-ray diffraction studies. Four crystallographic orientations, each different with respect to the compression axis, were selected in order to make the prospective twinning system planes, <11-21>, <11-22>, <10-11> and <10-12>, subject to a maximum resolved shear stress, i.e., Schmid factor = 0.5. <11-21> type twins were the most frequently observed in all the crystals tested and <10-12> type twins were the second most frequent. The second undistorted planes of twinning, K sub 2, for (-1-121) and (10-12) twins were determined to be the (0001) plane and (-1012) plane, respectively, from the inflection angle of small angle boundaries which had been sheared by twinning. In order to examine the critical resolved shear stress law Schmid factor analysis has been made. Twinning systems with Schmid factors less than 0.5 were not easily activated possibly because the required shear stress was much higher than the systems with a Schmid factor of 0.5. Consequently, the possible existence of CRSS law in twinning is negative. Author (TAB)

N71-10553# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
MOSSBAUER EFFECT APPLICATION Final Report,

1960–1969
Sergio De Benedetti, Fernando De S. Barros, and William T. Oosterhuis 17 Aug. 1970 10 p refs
(Contracts Nonr-760(20); N0014-67-A-00314-0005)
(AD-710808) Avail: NTIS CSCL 20/12

The report contains a brief outline of the research work performed. It lists the Ph.D.'s and the sixty-six publications supported by the contract. Author (TAB)

N71-10559# National Bureau of Standards, Washington, D.C.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS
H. E. Swanson, H. F. McMurdie, M. C. Morris, and E. H. Evans Sep. 1970 173 p refs
(NBS-Monograph-25-Sect-8) Avail: SOD $1.50 Catalog No. C13.44:25/Sec.8

Fifty-three of the patterns represent experimental data and 28 are calculated. The experimental X-ray powder diffraction patterns were obtained with an X-ray diffractometer, using samples of high purity. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated, and the refractive indices were measured whenever possible. The calculated X-ray power diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns. Author

N71-10607* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING A SILICON SEMICONDUCTOR DEVICE Patent
Joseph Mandelkorn, inventor (to NASA) Issued 28 Mar. 1967 (Filed 16 Mar. 1964) 3 p Cl. 148-1.5
(NASA-Case-XLE-02792; US-Patent-3,311,510; US-Patent-SN-352400) Avail: US Patent Office CSCL 20L

A method is described for an improved silicon material for semiconductor devices having a small quantity of a rare earth element or compound in the silicon. Small amounts of the rare earth element or compound are added to the semiconductor material to reduce its resistivity and to preserve good material properties. As an example, gadolinium was added to silicon used for fabrication of solar cells. Cells manufactured from such materials are shown to be more resistant to radiation damage. R.B.

N71-10631# Toronto Univ. (Ontario). Lash Miller Chemical Labs.
MOLECULAR INTERACTIONS AND CRYSTAL STRUCTURES AT LOW TEMPERATURES Final Report
Stanley C. Nyburg Jan. 1970 19 p refs
(Grant AF-AFOSR-1549-68)
(AD-711096; AFOSR-70-2290TR) Avail: NTIS CSCL 20/2

The report describes present states of knowledge concerning forces between molecules as obtained from crystal structure studies. Described are attempts to find crystal structure of Freon 22 just below its melting point. Author (TAB)

N71-10644 Lockheed Missiles and Space Co., Palo Alto, Calif.
LIGHT MODULATION BY AN ELECTRICAL FIELD IN CdTe
G. A. Babonas et al [1970] 3 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), No. 8, 1970 p 64–65
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The use of the low inertia of the Franz-Keldysh effect to fabricate the high frequency modulation of light, based on the change in the optical transmission of semiconductors in strong electrical fields, is discussed. A p-n junction was used to investigate light modulation by a strong electrical field in thin CdTe layers. The results show that thin CdTe layers can be used as a narrowband light modulator, in which the modulation coefficient reaches 40% in the domain of magnification of transmission under optimal conditions. Author

N71-10681# Mellon Inst., Pittsburgh, Pa.
DEFECT STATES IN GLASSY AND CRYSTALLINE SILICATES Final Summary Report, 1 Aug. 1965–30 Nov. 1969
John H. Mackay, Jr. Nov. 1969 15 p refs
(Grants AF-AFOSR-0974-66; AF-AFOSR-0974-67)
(AD-710303; AFOSR-70-2139TR) Avail: NTIS CSCL 20/12

The objective of the research was to determine the basic chemical properties and structure of localized defects in simple glassy and crystalline silicates. The principal tools used in these studies were optical spectroscopy and paramagnetic Resonance (EPR). The results which are summarized were as follows: The type of charge trapped by the centers responsible for the principal optical absorption bands in irradiated sodium silicate glasses of high purity were determined; The emission and absorption characteristics of Eu(+2) and Eu(+3) were examined and used to study the redox properties of this couple in sodium silicate glasses and fused silica; The chemical incorporation of nitrogen into simple silicate glasses under reducing conditions was studied; The EPR spectra of simple organo-silicon compounds contraining C, N, O, and H were studied after x- and UV-irradiation to determine the nature of the radicals formed in the solid state; The types of defects associated with substitutional aluminum in glassy and crystalline varieties of SiO2 have been examined by EPR spectroscopy. Author (TAB)

N71-10688# Columbia Univ., New York. Henry Krumb School of Mines.
MOSSBAUER SPECTROSCOPY OF FERROMAGNETIC MATERIALS Final Report
David I. Paul, Paul Hauser, and Rowland Levy Aug. 1970 38 p refs
(Contract N00014-67-A-0108-0007)
(AD-711105) Avail: NTIS CSCL 20/12

The report contains information on the investigation of the iron nuclear hyperfine resonance in the presence of a rare earth environment and the nature of the palladium-iron giant magnetic moment as modified by the addition of varying amounts of silver. Author (TAB)

N71-10689# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ON CONTINUUM ASPECTS OF GRAIN BOUNDARY SLIDING AND DIFFUSIONAL CREEP
M. F. Ashby and R. Raj Jun. 1970 77 p refs
(Contract N00014-67-A-0298-0020)
(AD-711088; TR-2) Avail: NTIS CSCL 20/12

The problem of sliding at a non-planar grain boundary is considered in detail. The stress field, and sliding displacement and velocity can be calculated at a boundary with a shape which is periodic in the sliding direction (a wavy or stepped grain boundary): (a) When deformation within the crystals which meet at the boundary is purely elastic. (b) When diffusional flow of matter from point to point on the boundary is permitted. Author (TAB)

N71-10684# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
PHYSICS OF STIMULATED EMISSION IN II-VI SEMICONDUCTING COMPOUNDS: THEORETICAL INVESTIGATION OF THE PRINCIPLES OF OPERATION OF THIN-FILM SEMICONDUCTOR LASERS Research and Development Report, Nov. 1968–Apr. 1970
H. F. Taylor 3 Jun. 1970 41 p refs
(AD-710988; NELC-TR-1713) Avail: NTIS CSCL 20/12

The literature related to stimulated emission in II-VI semiconducting compounds is summarized. Stimulated emission gain curves are calculated for CdSe. Author (TAB)

N71-10730# Alabama Univ. Research Inst., Huntsville.
ENERGY TRANSFER IN SOLIDS Final Technical Report, 25 Feb. 1969 – 25 May 1970
J. F. Porter, Jr. Jul. 1970 28 p refs
(Contracts DAAH01-69-C-1096; DAHC04-67-C-0068)
(AD-711063; UARI-RR-83) Avail: NTIS CSCL 7/4

A summary is given of the results of research directed largely to an increased understanding of cooperative phenomena observed to occur between simpurity (dopant) ions in ionic crystals. The phenomena observed were (a) ion pair absorption in LaCl3 by Ho(3+) + Nd(3+), by Ho(3+) + Pr(3+), and by Pr(3+) + Nd(3+), in which case one photon is absorbed by two ions; (b) satellite structure in which case the perturbation caused by the mutual interaction of neighboring ions produces a shift and splitting of the energy levels relative to the single Ho(3+) ion levels; (c) multiple ion relaxation processes in Ho(3+) doped LaCl3, in which case the excitation energy of a single ion is shared (nonradiatively) with one or more ions in the decay process. A subsidiary effort has been directed towards the understanding of the scattering mechanism responsible for the production of an emission continuum when materials typically used for infrared windows (and solid state laser host materials) are illuminated by intense monochromatic light. Author (TAB)

N71-10759# North Carolina Univ., Chapel Hill. Dept. of Physics.
VOLUME DEPENDENCE OF THE GRUNEISEN PARAMETER
R. W. Roberts Dec. 1969 22 p refs
(ORO-3802-6; TR-5) Avail: NTIS

A thermodynamic method was developed to compute values of din gamma/dlnV) sub T from published ultrasonic data for the sodium, potassium, and rubidium halides. The resulting values range from 1.5 to 2.0, with the more classical rubidium halides possessing the larger values. When discussed in terms of the quasiharmonic model, the high temperature limit of dln gamma/dlnV)sub T relates directly and very simply to the volume dependence of the mode frequencies, omega sub i. This volume dependence is expressed in terms of gamma sub i = −d l n omega sub i/dlnV)sub T and dln gamma sub i/dlnV) sub T. It is shown that dln gamma sub i/dlnV) sub T is given by 1 + gamma sub i + sigma sub i, where sigma sub i characterizes the second volume derivative of omega sub i. Born Model estimates of the sigma sub i are found to be nearly invariant for all the acoustic modes with a value of −2. Values of din gamma/dlnV)sub T were obtained from a numerical integration over the mode frequencies using this estimate of the average value of sigma sub i and values of the gamma sub i derived from the pressure derivatives of the elastic constants. Author

N71-10864# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF DEFECTS INDUCED BY LOW-ENERGY PROTONS ON DIFFUSION LENGTH OF MINORITY CARRIERS IN P-TYPE SILICON
G. M. Grigoreva et al 22 Jul. 1970 9 p refs Transl. into ENGLISH from Russian report
(AD-711750; FTD-HT-23-297-70) Avail: NTIS CSCL 20/12

The authors describe the results of investigations into the effect of irradiation by protons with energies E equals 1-6 MeV on electron diffusion length in p-type silicons. Two types of silicon were investigated: silicon obtained by melt extrusion and doped with boron at a given concentration, and noncrucible, vacuum-grown silicon doped with aluminum in a given concentration. Analysis of the spectral characteristics of n-p-structures revealed variations in the diffusion length of minority current carriers in p-type silicon due to defects induced by proton bombardment. The anomalous results for electron diffusion length after irradiation by 1 and 2 MeV protons is attributed to the diffusion length measurement method. Discrepancy between experimental and theoretical curves for electron diffusion length changes following irradiation by protons with energies E equals 4-6 MeV is attributed to defect annealing. Author (TAB)

N71-10882# Air Force Cambridge Research Labs., Bedford, Mass.
SOME REACTIONS OF TUNGSTEN (6) OXIDE AND MOLYBDENUM (6) OXIDE WITH LIQUID SULFUR
John W. Goodrum 23 Jul. 1970 34 p refs
(AD-711641; AFCRL-70-0417) Avail: NTIS CSCL 7/2

In situ generation of species for crystal growth in solution is a relatively undeveloped, but promising technique for preparation of solid state material. In this work a solvent, liquid sulfur, generates species in solution by chemical reduction at high temperatures. Evaluation of this high temperature reduction agent included measurements of qualitative and kinetic parameters for the reactions molybdic oxide - sulfur and tungstic oxide - sulfur as a function of temperature, time, and atmosphere. Temperature effects on reduction rate over the range 125 to 400C were markedly non-linear. Reduction products isolated include Mo(IV) oxide at 250C; Mo(IV) sulfide at 400C; W(IV) sulfide at 400C. The oxidation product detected whenever reduced species were found was sulfur(IV) oxide. Additional evidence of species WO(x)S(y) and polymeric sulfur was found. Results of this study indicate that liquid sulfur can serve as a straightforward reducing agent at high temperatures. The rate or extent of such reduction is easily controlled by varying thermal conditions or duration of reaction, and the products of such reductions may be readily isolated by solution techniques which remove unreacted sulfur. Author (TAB)

N71-10917# Minnesota Univ., Minneapolis. School of Mineral and Metallurgical Engineering.
STUDIES OF THIN FILM HARD SUPERCONDUCTORS Final Technical Report, 25 Oct. 1968 – 31 Dec. 1969
Louis E. Toth and Y. M. Shy Feb. 1970 123 p refs
(Contract DA-44-009;AMC-812(T))
(AD-710960) Avail: NTIS CSCL 20/3

Superconducting thin nitride films have been prepared by reactive sputtering. The films have very high superconducting T sub cs and excellent (J sub C)-H characteristics. The superconducting properties and the electrical resistivities of these films were studied as a function of sputtering parameters such as nitrogen partial pressure, deposition rate, substrate temperature and substrate materials. The properties of the films were then related to the structure of the films by electron microscopy studies. The effects of annealing the films were studied. Electrical resistivities and the temperature coefficient of the resistivities were determined. Author (TAB)

N71-10926*# Delaware Univ., Newark. Dept. of Physics.
X-RAY AND ELECTRON DAMAGE OF CADMIUM SULFIDE
K. W. Boer Washington NASA Nov. 1970 23 p refs
(Contract NAS1-8787)
(NASA-CR-1700) Avail: NTIS CSCL 20L

Studies of X-ray damage were performed on Class 1 (Gross-Novikov) and Class 2 cadmium sulfide crystals. Changes in Class 1 spectral dependence photocurrents (SDP) and thermally stimulated currents (TSC) crystals irradiated at 200 keV X-rays are compared to observations of 250 keV irradiated Class 2 crystals. The observations were attributed to the fact that the surface is especially sensitive to either ambient or to near surface layer radiation damage. Therefore, damage threshold might be considerably lower for Class 1 crystals. Studies of damage in Class 2 crystals irradiated at 250 keV showed a TSC peak attributable to sulfur vacancies. The lifetime of the electrons increased rather than decreased. Author

N71-10953# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
SURFACE-SENSITIVE MECHANICAL BEHAVIOR OF

NICKEL MONOCRYSTALS
R. M. Latanision Aug. 1970 10 p refs
(Contract N00014-70-C-0255)
(AD-711677; RIAS-TR-70-8C; TR-1) Avail: NTIS CSCL 20/12

It is suggested that near-surface vacancy and solute concentration gradients, image force effects, and notch effects due to surface ledges principally affect the yielding of film-free metal monocrystals through the action of near-surface dislocation sources. Once the specimen has yielded, then energetic problems associated with the creation of surface slip steps, and various factors introducing near-surface lattice distortions tend to inhibit dislocation emergence and lead to a preferentially work hardened surface layer. At the same time the glide of half-loops into the interior of the crystal is expected to create a disparity of dislocation signs near the surface. The above factors have been taken into account in interpreting the effects of electrochemical polarization during deformation on the mechanical behavior of nickel monocrystal electrodes. Author (TAB)

N71-10954# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
FATIGUE CRACK PROPAGATION IN COPPER AND COPPER-ALUMINUM SINGLE CRYSTALS
Hitoshi Ishii and Johannes Weertman 27 Aug. 1970 98 p refs
(Contract Nonr-1228(32))
(AD-711678; TR-9) Avail: NTIS CSCL 20/12

The effects of crystallographic orientation, temperature and stacking fault energy on the rate of fatigue crack propagation have been studied in polycrystalline copper, copper single crystals and copper-aluminum single crystals at room temperature and at liquid nitrogen temperature. The results were discussed in terms of cyclic hardening and the case of dislocation cross slip. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-10398# Aerojet-General Corp., Sacramento, Calif.
APPLICATIONS OF CUMULATIVE DAMAGE IN THE PREPARATION OF PARAMETRIC GRAIN DESIGN CURVES AND THE PREDICTION OF GRAIN FAILURES ON PRESSURIZATION. VOLUME 1: TEST Final Report, 1 Apr. 1969 - 28 Feb. 1970
Kenneth W. Bills, Jr., Douglas M. Campbell, Robert D. Steele, Joseph D. McConnell, and Leonard R. Herrmann Aug. 1970 123 p refs
(Contract N00017-69-C-4423)
(AD-710774; Rept-1341-26F-Vol-1) Avail: NTIS CSCL 21/9.2

The program was designed to accomplish realistically obtainable objectives with the aim that the resulting technology would be immediately useful. The goal was to advance the state-of-the-art in viscoelastic stress analyses and to extend the range of application of the linear cumulative damage relation for solid propellants. The research and development efforts were directed to the development of practical tools for engineering, propellant development and mechanical property characterizations. Author (TAB)

N71-10399# Aerojet-General Corp., Sacramento, Calif.
APPLICATIONS OF CUMULATIVE DAMAGE IN THE PREPARATION OF PARAMETRIC GRAIN DESIGN CURVES AND THE PREDICTION OF GRAIN FAILURES ON PRESSURIZATION. VOLUME 2: APPENDICES A THROUGH M Final Report, 1 Apr. 1969 - 28 Feb. 1970
Kenneth W. Bills, Jr., Douglas M. Campbell, Robert D. Steele, and Joseph D. McConnell Aug. 1970 154 p refs
(Contract N00017-69-C-4423)
(AD-710775; Rept-1341-26F-Vol-2) Avail: NTIS CSCL 21/9.2

Contents: Modulus data input for the computer; Parameter study for History 1; Parameter study for History 2; A new normalized relation for the relaxation modulus; Incremental analysis procedure; Prony series curve fit analysis; Inclusion of non-zero thickness stresses in plane stress analyses; A computer program for viscoelastic solids of revolution subjected to time-varying thermal and mechanical load environments - version 2.1; Non-linear analyses based on propellant dilatation; Basic cumulative damage equations; Study of propellant failure under pressure; Effects of previous damage; and Input data for pressurization tests on a PBAN propellant. TAB

N71-10452*# TRW Systems Group, Redondo Beach, Calif.
GAS-LIQUID SPACE STORABLE PROPELLANT PERFORMANCE Final Report
W. A. Carter 2 Jan. 1970 110 p refs
(Contract NAS3-13307)
(NASA-CR-72708; TRW-13462-6001-R0-00) Avail: NTIS CSCL 21I

Design criteria were developed for a high performance coaxial (pintle) injector. The propellant combination was gaseous methane and liquid FLOX. Nominal engine design/operating conditions were 3000 lbf sea level thrust at a chamber pressure of 500 psia and mixture ratio of 5.75. Experimental variables evaluated included several injection orifice geometries, engine mixture ratio (5.0 to 6.5), and thrust chamber characteristic length, 15 to 60 inches. Demonstrated performance with the nominal 30 inch characteristic length chamber at the design 5.75 mixture ratio was 97% of the theoretical equilibrium characteristic velocity. Engine dynamic stability was demonstrated with a pulse gun induced excitation test, and a single extended duration test was conducted. Author

N71-10562# Aerojet Solid Propulsion Co., Sacramento, Calif.
APPLICATIONS OF NON-LINEAR VISCOELASTICITY AND CUMULATIVE DAMAGE. A REALISTIC EVALUATION OF REAL PROPELLANT BEHAVIOR Quarterly Report, 1 Apr.-30 Jun. 1970
Kenneth W. Bills, Jr. and Leonard R. Herrmann (Calif. Univ., Davis) Jul. 1970 36 p refs Prepared in cooperation with Calif. Univ., Davis, Calif.
(Contract N00017-70-C-4441)
(AD-710776; Rept-1565-26-Q-1; QR-1) Avail: NTIS CSCL 21/9.2

A study was undertaken to provide a realistic evaluation of real propellant behaviors, with emphasis upon the effects of larger strains and their attendant marked nonlinear viscoelastic behavior. To accomplish this primary objective, efforts were made to: (1) evaluate the nonlinear viscoelastic response properties of solid propellants in terms of the theories of Ferris, and reduce to practice the associated analytical methods; and (2) develop a practical, empirical method of calculating cumulative damage in terms of a strain failure criterion. Author (TAB)

N71-10589# Naval Ordnance Lab., White Oak, Md.
THE SENSITIVITY OF SELECTED CONVENTIONAL AND HEAT RESISTANT EXPLOSIVES AT LOW TEMPERATURES
Calvin L. Scott 12 May 1970 21 p refs
(AD-710738; NOLTR-70-36) Avail: NTIS CSCL 19/1

The effects of temperature, confinement, and column diameter on the shock sensitivity of some heat resistant and conventional booster-type explosives were studied in a gap test arrangement.

As expected, sensitivity decreased with decreasing temperature. Also, as expected, the changes in sensitivity with temperature were small compared to the sensitivity effects of confinement and charge diameter. Author (TAB)

N71-10689# Utah Univ., Salt Lake City. Coll. of Engineering.
HOMOGENEOUS CONSTITUTIVE EQUATIONS FOR MATERIALS WITH PERMANENT MEMORY
Richard John Farris (Ph.D. Thesis) Jun. 1970 157 p refs
(Contract F44620-68-C-0022)
(AD-711657; THEMIS-UTEC-TH-70-083; AFOSR-70-1962-TR) Avail: NTIS CSCL 20/11

Nonlinear homogeneous constitutive equations are developed in this thesis for highly filled polymeric materials such as solid propellants. In the range of strains below vacuole dilatation these materials obey the homogeneity rule of linearity but do not obey the superposition rule. Such materials typically exhibit an irreversible stress softening called the Mullins Effect. The development in this dissertation stems from attempting to mathematically describe the failing microstructure of these composite materials in terms of a linear cumulative damage model. It is demonstrated that pth order Lebesgue norms of the strain history can be used to describe the state of damage in these materials and can also be used in the constitutive equation to characterize their time dependent mechanical response to strain disturbances. Stress analysis procedures for materials having nonlinear homogeneous constitutive equations are developed for two and three dimensional proportional boundary value problems. A series of correspondence principles are derived wherein half of the solution, either the stresses or the strains, can be obtained by solving an equivalent linear elastic problem. The remaining half of the solution can be obtained by substituting the linear elastic solution into the nonlinear homogeneous constitutive equation. Author (TAB)

N71-10756# Los Alamos Scientific Lab., N.Mex.
EFFECT OF INHOMOGENEITIES IN AN EXPLOSIVE ON THE CRITICAL DIAMETER OF DETONATION
S. S. Rybanin Mar. 1970 9 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 4, 1969 p 141–144
(LA-TR-70-7) Avail: NTIS

A theoretical analysis of inhomogeneities in an explosive on the critical diameter of detonation is performed. An equation is obtained for determining the critical diameter as a function of the concentration and size of the inhomogeneities. It is shown that in the case of the inhomogeneities being particles of an inert substance added to the explosive, the dependence of the critical diameter on the weight fraction and size of the inert substance particles can have a minimum. The results of the analysis agree qualitatively with the experimental data. Author

N71-10972# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERNAL BALLISTICS OF TUBE ARTILLERY SYSTEMS AND POWDER ROCKETS (EXCERPTS)
M. Ye. Serebryakov 14 Jan. 1970 119 p refs Transl. into ENGLISH from the publ. "Vnutrennyaya Ballistika Stvolnykh Sistem i Porokhovykh Raket" Moscow, 1962 p 1–41, 54–57, 72–105, and 697–707
(AD-711270; FTD-HT-23-302-69) Avail: NTIS CSCL 19/7

The third edition of this book has been thoroughly revised and includes new material reflecting the results of recent investigations in the domain of internal ballistics. The book describes the general theoretical bases of the internal ballistics of various types of barrel systems and powder rockets as well as contemporary methods for solving its chief problems. Special attention is devoted to the physical aspect of the processes involved, the laws of heating of the powder charges, and the principles of the processes acting in the channel of the gun barrel and in the chamber of the rocket. The book is not only a textbook for students in technical institutes but should be useful also to technicians and engineers in industry concerned with artillery. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-10012*# Rocketdyne, Canoga Park, Calif.
LIQUID ROCKET PERFORMANCE COMPUTER MODEL WITH DISTRIBUTED ENERGY RELEASE Interim Final Report, 15 Aug. 1969–15 Aug. 1970
L. P. Combs, W. D. Chadwick, and D. T. Campell 11 Sep. 1970 65 p refs Prepared for JPL
(Contracts NAS7-746; NAS7-100)
(NASA-CR-111000; R-8298) Avail: NTIS CSCL 21H

An analytical computer program was developed by modifying and combining existing spray formation and subsonic combustion programs with reference programs for transonic and supersonic nozzle flow. The new distributed energy release program accounts analytically for the combustion energy release losses resulting from imperfect propellant spray mixing and incomplete spray gasification upstream of the nozzle throat. Program verification was sought by comparing predicted performance with available experimental data. After some manipulation of spray collection plane location, drop size formulas and method of initializing stream tubes, good agreement of characteristic exhaust velocity efficiencies for FLOX/LPG propellants was obtained. Parameters varied were like-doublet-pair injection element design details, chamber length and contraction ratio, chamber pressure and mixture ratio. Just one of these cases was carried through to complete calculation of specific impulse; the calculated value was about 2% higher than expected. Possible causes of this discrepancy are discussed. Author

N71-10041*# TRW Systems, Redondo Beach, Calif.
TASK 6 STORABLE PROPELLANT MODULE ENVIRONMENTAL CONTROL TECHNOLOGY Summary Report
R. R. De Land, O. O. Haroldsen, L. R. Kelley, and R. N. Porter 17 Jul. 1970 73 p refs
(Contract NAS7-750)
(NASA-CR-111082; TRW-14051-6007-T0-00) Avail: NTIS CSCL 21H

From a thermal requirements point of view, the major difference between the current F2/N2H4 system and the previous OF2/B2H6 system is that the two propellants for the current system must be stored at widely different temperatures (fluorine < 200 R, hydrazine 490 – 560 R), whereas with the previous system, both propellants could be stored at approximately 250 R. Because of the large temperature gradient, the low fluorine temperature, and the no vent requirement, the RTG was repositioned out of view of the fluorine tank, boron filament support tubes were replaced on the fluorine tank by lower conductance epoxy fiberglass tubes, flat plate radiation shields were placed between tanks, and solar impingement on the fluorine tank, its support struts and plumbing lines was restricted to short periods (t < 10 days). Preliminary calculations show that under these conditions, passive radiation from the insulated fluorine tank to space can maintain the fluorine at an equilibrium temperature of approximately 100 R (with a hydrazine temperature of 530 R). Heat capacity of the fluorine and its tank would then provide a maximum margin of safety in the event of inadvertent heat leaks or solar impingement. Author

N71-10045*# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW COST TURBOPUMP STUDY Management Summary of Final Report, 30 Jun. 1969 – 13 Feb. 1970
M. W. Young and S. L. Sachs 17 Jul. 1970 39 p
(Contract NAS8-24859)
(NASA-CR-110996; ALRC-2100-4) Avail: NTIS CSCL 13K

A methodology was developed for synthesizing the lowest cost turbopumps for a particular mission. The modified methodology permits synthesis of the lowest overall cost system by including cost as an initial factor. Any methodology developed for the turbopump portion of the system offers a high potential for applicability to the other elements of the engine/vehicle system. Author

N71-10123# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
PARAMETRIC STUDY OF ROCKET MOTOR COMBUSTION INSTABILITY Final Scientific Report
John R. Osborn Jul. 1970 19 p refs
(Grant AF-AFOSR-1420-68)
(AD-710312; AFOSR-70-1875TR) Avail: NTIS CSCL 21/8.1

The research program has been concerned with an experimental and analytical investigation conducted for evaluating the influence of combustion chamber pressure and propellant temperature effects on liquid rocket combustion dynamics. The experimental program was conducted with a small-scale rocket engine thrust chamber assembly using bi-phase propellants. Air was used as the oxidizer and normal heptane was used as the fuel. Chamber pressures investigaged ranged from 250 to 1000 psia; values below the critical pressure of the fuel to ones considerably above it. The values for the initial temperature of the injected fuel ranged from 520 to 910R. It was found that increasing the chamber pressure has a strong stabilizing effect, increasing the initial fuel temperature has a slight destabilizing effect, and decreasing the drop size has a strong destabilizing effect. Two combustion models were used for obtaining analytical predictions of the stability behavior for correlating the experimental results and for determining the validity of the models. General agreement was found between the experimental results and the analytical predictions. Author (TAB)

N71-10266*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED CONCEPTS: PROPULSION DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 148 – 152 refs (See N71-10251-01-34)
Copyright. Avail: NTIS CSCL 21H

The results of an experiment to determine ion thruster hollow cathode operating temperature are reported. The effects of cathode orifice geometry changes on both temperature and thruster operation are discussed. Experimental results are reported on the performance of a supersonic nozzle with a 75 deg convergent half-angle and a small throat radius of curvature. Thrust, flow coefficient, and specific impulse were evaluated and the results agree well with those obtained for conventional nozzles with 15 deg divergent cones. R.B.

N71-10267*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID PROPULSION: PROPULSION DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 153 – 161 refs (See N71-10251-01-34)
Copyright. Avail: NTIS CSCL 21H

An engine module with 380 second accumulated burn time was tested to determine the performance of a flight-qualified engine in a simulated thermoelectric outer planet spacecraft mission duty cycle for midcourse correction. Research progress is reported on injector and thrust chamber design criteria applicable to the development of rocket engines for unmanned spacecraft, using the space-storable propellant combination of oxygen difluoride and diborane. R.B.

N71-10278*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EFFECT OF NOZZLE LATERAL SPACING ON AFTERBODY DRAG AND PERFORMANCE OF TWIN-JET AFTERBODY MODELS WITH CONVERGENT NOZZLES AT MACH NUMBERS UP TO 2.2
Donald L. Maiden and Jack F. Runckel Washington Oct. 1970 142 p refs
(NASA-TM-X-2099; L-7192) Avail: NTIS CSCL 21H

Twin-jet afterbody models were investigated by using two balances to separately measure the thrust minus afterbody drag and the afterbody drag at static conditions and at Mach numbers up to 2.2 for a constant angle of attack of 0 deg. Hinged-flap convergent nozzles were tested at dry- and afterburner-power settings with a high-pressure air system used to simulate jet-total-pressure ratios up to 21.0. Equal nondimensional area distributions were maintained as the nozzle lateral spacing was varied. In addition to the lateral-spacing study, afterbodies with recessed blunt bases were investigated, and the effects of exposing primary nozzle flaps to free-stream flow were examined. The results indicate an increase in afterbody axial-force (drag) coefficient with increased lateral spacing for the shrouded and unshrouded configurations for subsonic and supersonic Mach numbers, with the exception of the shrouded dry-power nozzle configurations at subsonic Mach numbers (for which the trend was opposite). Author

N71-10282*# Scientific Translation Service, Santa Barbara, Calif.
A STUDY ON A VAPORIZING COMBUSTOR FOR GAS TURBINES
Shoichi Tsuji Washington NASA Oct. 1970 64 p refs Transl. into ENGLISH from Ishikawajima-Harima Rev. (Japan), v. 9, Sep. 1969 p 473 – 484
(Contract NASw-2035)
(NASA-TT-F-13272) Avail: NTIS CSCL 21E

A new type of film vaporizing combustor for gas turbines is proposed, which should mark an advance over the conventional combustor. The theoretical and experimental study undertaken in this connection covers such aspects as vaporizing characteristics of liquid fuel film, flame spreading and stability, performance tests on actual combustors, and practical design considerations. A combustion experiment using a square section simplified model of a jet engine combustor is described. The results attest to the superiority of the combustor over conventional types in such aspects as combustion efficiency and intensity. Proposed applications and design procedures are discussed, as well as the prospects of realizing practical combustors for actual use. Author

N71-10441*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF ELECTRIC PROPULSION SPACECRAFT PLASMAS AND FIELD INTERACTIONS Final Report
Robert K. Cole, H. S. Ogawa, and J. M. Sellen, Jr. 1 Jul. 1970 278 p refs Prepared for JPL
(Contract NAS7-100; JPL-952414)
(NASA-CR-110912; TRW-12738-6016-R0-00) Avail: NTIS CSCL 21C

The operation of a solar-electric spacecraft was studied relative to the possible impact on the operation of the payload. Magnetic, electrostatic, space plasma, and electromagnetic contamination levels from the operation of the electric thruster and the associated solar array were analyzed. Recommendations in designing a solar array are given which result in reduced contaminant fields, so that interplanetary magnetic field measurements may be performed without interference from the solar array. Technical reports and published papers are included. F.O.S.

N71-10537*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF SIMULATED DOWNSTREAM FLOW BLOCKAGE DOORS ON THE PERFORMANCE OF AN AXIAL-FLOW FAN ROTOR

Walter M. Osborn and Jack M. Wagner Washington Nov. 1970 26 p refs
(NASA-TN-D-6071; E-5215) Avail: NTIS CSCL 21E

Two downstream flow blockages simulating door positions of 20 deg and 45 deg in the bypass air duct of a turbofan engine were tested with an axial flow fan rotor. The rotor performance was stable and repeatable, and both configurations suppressed rotating stall. At the minimum flow points, an increase in inlet temperature in the tip region indicates the existence of an eddy flow. Temperatures remained within operational limits. Reductions in torque and flow rate with the 45 deg blockage ring indicate that a flow blockage device might ease engine starting requirements and might be used to reduce engine thrust while maintaining high engine speed. Author

N71-10564# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
RESEARCH ON FAILURE INDICATOR SYSTEM Interim Report, 1 Aug. 1969 – 31 Jul. 1970
Gordon R. Knight 1 Aug. 1970 73 p
(Contract N00014-67-C-0401)
(AD-710809; RR-70-10; IR-3) Avail: NTIS CSCL 14/2

Recording and frequency analysis of vibration data by means of coherent optical data processing techniques is described with special emphasis on the detection or diagnosis of failures in rotating mechanisms. Vibration signals from gas turbine engines and bearings were analysed and compressor, turbine, bearing, and gear components were identified in the optical spectrum. Author (TAB)

N71-10574* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROSTATIC THRUSTOR WITH IMPROVED INSULATORS Patent
David C. Byers, Paul M. Margosian, and Glen E. Mealy inventors (to NASA) Issued 13 Jun. 1967 (Filed 7 Sep. 1965) 4 p Cl. 60-202
(NASA-Case-XLE-01902; US-Patent-3,324,659; US-Patent-Appl-SN-485656) Avail: US Patent Office CSCL 21C

High voltage insulators for direct current in a vacuum environment are described. Electrons released by field emission are constrained in the region of the negative junction to eliminate surface flashover and unstable operation. The insulators are used in the acceleration system of an electrostatic thrustor. R.B.

N71-10602*# General Dynamics/Convair, San Diego, Calif.
LOW GRAVITY PROPELLANT CONTROL USING CAPILLARY DEVICES IN LARGE SCALE CRYOGENIC VEHICLES (DESIGN HANDBOOK)
Aug. 1970 140 p refs
(Contract NAS8-21465)
(NASA-CR-102901; GDC-DDB70-006) Avail: NTIS CSCL 21H

Expulsion of a fluid from a propellant tank in low gravity requires a means of positively controlling the liquid/vapor interface. Studies of both cryogenic and noncryogenic vehicle missions have indicated the usefulness of utilizing capillary devices to accomplish this propellant control. The design criteria for these devices is presented. A separate detailed summary of the design approach for the fluid, thermal, and structural aspects is given. The approach summaries are followed by a flow chart of the steps required for developing a final design and concluded with a detailed discussion of individual design principles and technical problem solutions. Author

N71-10642 Lockheed Missiles and Space Co., Palo Alto, Calif.
LOW THRUST ENGINES
I. Pavlov [1970] 6 p Transl. into ENGLISH from Aviats. i Kosmonaut. (Moscow), no. 8, 1970 p 38–39
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The various types of low thrust microengines used to control the rolling, yawing, and pitching moments of space vehicles are discussed. Methods are described for increasing the specific impulse of microengines according to the fuel used. R.B.

N71-10653*# General Dynamics/Convair, San Diego, Calif.
LOW GRAVITY PROPELLANT CONTROL USING CAPILLARY DEVICES IN LARGE SCALE CRYOGENIC VEHICLES, PHASE 1 Final Report
Aug. 1970 138 p refs
(Contract NAS8-21465)
(NASA-CR-102900; GDC-DDB70-007) Avail: NTIS CSCL 21H

This report covers work performed during the first phase of a study on: low gravity propellant control using capillary devices in large scale cryogenic vehicles. Discussed are the missions of interest, problem areas, methods of solving these problems with corresponding results, preliminary capillary containment system design concepts which were considered and comparisons of promising capillary devices with other means of propellant control. The missions considered were an S-4C LH2 and LO2 tank restart in orbit and a propellant transfer mission using a LOX tanker to fill an S-2B. Author

N71-10763*# TRW Systems, Redondo Beach, Calif.
THROTTLEABLE THRUSTOR SYSTEM Final Report
R. J. Kenny and D. F. Reeves 28 Apr. 1970 102 p Prepared for JPL
(Contract NAS7-100; JPL-952344)
(NASA-CR-110903; Rept-70.4726.3-28) Avail: NTIS CSCL 21H

A three-phase effort to develop a throttleable monopropellant hydrazine thrustor system for planetary lander vehicles is summarized. A tradeoff study with total system weight as the primary criteria included 300 to 1200 lbf thrust catalytic and thermal decomposition chambers, electromechanical and electrohydraulic throttle valve actuation, and various control techniques. Based on these studies, a 600 lbf catalytic throttleable thrustor system weighing 14.8 pounds was designed, fabricated, and demonstrated. This thrustor, together with an electromechanically actuated throttle valve incorporating position feedback control, demonstrates performance/response levels consistent with planetary lander requirements. Author

N71-10780* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITE POWERPLANT AND SHROUD THEREFOR Patent
William J. D. Escher, inventor (to NASA) Issued 2 May 1967 (Filed 1 Jul. 1964) 7 p Cl. 60-225
(NASA-Case-XLA-01043; US-Patent-3,316,716; US-Patent-Appl-SN-379768) Avail: US Patent Office CSCL 21H

A propulsion system with a fan and rocket engine combination and a thrust chamber shroud is described. The system's objective is to provide a launch vehicle with an engine that will operate in varying atmospheric conditions. J.A.M.

N71-10853# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION GAS TURBINE ENGINES. CONSTRUCTION AND DESIGN OF PARTS
G. S. Skubachevskii 19 Jun. 1970 851 p refs Transl. into ENGLISH of the book "Avyatsionnye Gazoturbinnye Dvigateli. Konstruktsiya i Raschet Detalei" Moscow, Mashinostroyeniye, 1969 p 1–543
(AD-711757; FTD-MT-24-65-70) Avail: NTIS CSCL 21/5

In the textbook design fundamentals of aviation gas turbine engines are expounded. There is an examination of operating conditions of individual subassemblies of engines and their parts and the demands imposed on them, construction of parts, strength and

vibration calculations; requirements are presented for materials from which parts are prepared, and certain technological indications are outlined. Examples of strength and vibration calculations of basic parts of gas turbine engines are provided. The third edition includes up-dated examples of engine structures and their parts, new methods for calculating strength and vibration and examples of calculations are given. The textbook is intended for students of aviation technical institutes. TAB

N71-10905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN CONSIDERATIONS AND REQUIREMENTS FOR INTEGRATING AN ELECTRIC PROPULSION SYSTEM INTO THE SERT 2 AND FUTURE SPACECRAFT
Raymond J. Rulis Washington Nov. 1970 27 p refs
(NASA-TM-X-2082; E-5790) Avail: NTIS CSCL 21C

Integration of a new propulsion system into a spacecraft requires establishing design criteria for interface control. This report delineates problems encountered during the integration of an electric propulsion system into the SERT spacecraft. Design criteria are established for future applications for high voltage handling; thruster breakdown; thrust vector control; and mechanical, thermal, and electrical interfaces. Design considerations based on results from experiments aboard the SERT II spacecraft are discussed. Testing philosophy is presented for achieving long system life times in-orbit. Ground support equipment for propulsion system and integrated spacecraft testing during launch base activities is delineated. Author

N71-10912*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE SHUTTLE PROPULSION
Howard W. Douglass 1970 20 p Presented at 7th Ann. Meeting and Tech. Display, Houston, Tex., 19–22 Oct. 1970; sponsored by AIAA
(NASA-TM-X-52923) Avail: NTIS CSCL 21H

The major propulsion systems of the space shuttle presently contemplated by NASA are described. Their characteristics, functions, and status relative to the current technology are discussed. Selected examples are given which are representative of the problems to be solved in the developmental effort required for the shuttle to become a reality. Author

N71-10982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF TURBOJET COMBUSTOR DYNAMICS USING SWEEP-FREQUENCY DATA
John R. Szuch, Francis J. Paulovich, and William M. Bruton Washington Nov. 1970 42 p refs
(NASA-TN-D-6084; E-5595) Avail: NTIS CSCL 21H

The analysis of data obtained from sweep-frequency testing of the J85 turbojet combustor is discussed. Bode plots of the response of combustor pressure to sinusoidal disturbances in fuel-spray-nozzle pressure are presented for a range of fuel flows. An analog simulation was developed and used to match the experimental data and to identify the combustion dynamics. The effects of primary or burning-zone fuel-to-air ratio on the system response were also investigated. The experimental data were fit by linear transfer function forms to be used in overall system studies. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-10180# Nuclear-Chicago Corp., Austin, Tex. Nuclear Div.
SIMULATION AND MEASUREMENT OF SOLAR-FLARE PROTON EXPOSURES Final Report, Nov. 1968–Aug. 1969
Ben S. Burton, C. Varren Parker, Jr., Larry A. Boles, Edward F. Alexander, and John B. Nelson Brooks AFB, Tex. SAM Jun. 1970 20 p refs
(Contract F41609-69-C-0012)
(AD-711041; SAM-TR-70-38) Avail: NTIS CSCL 6/18

Analytical and experimental technics were developed for simulating solar-flare proton exposures. These technics were used to expose a series of animals (Macaca mulatta) to specified depth-dose distributions. The exposures were made with the nominal 300-Mev proton beam of the NASA Space Radiation Effects Laboratory synchrocyclotron. Details of the simulation and physical dosimetry measurements are presented. Author (TAB)

N71-10378# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Apr. 1970 30 p
(RRC-A178-Pt-2) Avail: NTIS

Solar and geophysical data related to ionospheric studies are tabulated and presented from four Indian stations. Optical observations of sunspots, solar flux, solar flares, and magnetic storms are included with predictions based on these observations. E.M.C.

N71-10401# Air Force Cambridge Research Labs., Bedford, Mass. Research Library.
THE DETERMINATION OF THE MAGNETIC FIELD STRENGTH FROM DIFFERENT ABSORPTION LINES
M. Dzh. Guseinov Apr. 1970 23 p refs Transl. into ENGLISH from Krymsk. Astrofizicheskaya Observ. Izv. (USSR), no. 69, 1969 p 253–264 *Its* Transl. No. 76
(AD-710690; AFCRL-70-0270) Avail: NTIS CSCL 3/2

On the basis of spectrograms, obtained with the echellette spectrograph of the tower solar telescope of the Crimean astrophysical observatory, the absolute values of the magnetic field strength H are determined from different absorption lines. It is found, that the magnetic field strength changes from one line to another and depends both on the Rowland intensity and on the excitation potential of the lower level of the line. There is a dependence between H and mean optical depths mean tau of lines. The field is very inhomogenous with depth and H increases, in the main, with the increase of mean tau. But in a separate case, there were both positive and negative gradients of the field into the depth of a spot. It has been determined that in the period from September 2 up to September 5, 1961 in the spot-leader of group No. 251 the coming up to the surface of the magnetic field took place, and during September 5-7 - the expansion of the field, mainly. Author (TAB)

N71-10432# Cornell-Sydney Univ. Astronomy Center, Sydney (Australia).
STUDY OF COSMIC RADIATIONS AT EXTREMELY HIGH ENERGIES Final Scientific Report
C. B. A. McCusker 13 Aug. 1970 18 p refs
(Grants AF-AFOSR-1486-68; AF-AFOSR-1486-68A)
(AD-710653; AFOSR-70-2220TR) Avail: NTIS CSCL 4/1

The three main purposes of the experiment, listed in the original research proposal, have already been achieved. These were to determine the slope of the cosmic ray energy spectrum to 10 to the 21st power eV, to study the arrival directions of very energetic particles, and to study nuclear interactions up to the maximum energy available. Author (TAB)

N71-10602# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
INVESTIGATION OF HORIZONTAL ION DENSITY

GRADIENTS IN THE ATMOSPHERE Final Report, 15 Jul. 1965–29 May 1970
Gerald W. Sharp, Richard D. Sharp, and Richard G. Johnson May 1970 71 p refs
(Contract Nonr-4969(00); ARPA Order 215)
(AD-710800; LMSC-L-39-70-1) Avail: NTIS CSCL 4/1

The final report is on a satellite measurement program to investigate the characteristics and causes of horizontal ion density gradients in the F-region ionosphere. The report covers the development of the payload, the satellite orbital operations, and the preliminary data analysis phase of the program. The satellite payload was successfully launched on the OV1-18 satellite on 18 March 1969 into a polar orbit with apogee at 590 km and perigee at 469 km. The payload performed generally well throughout the first years operation although the satellite failed to achieve the desired earthcentered orientation. A large body of generally high-quality flight data has been acquired that promises to yield significant results on the systematic relationships between the ionospheric structure at the satellite altitude and the input energy sources in the form of energetic particle fluxes. Electron density and temperature measurements with a Langmuir probe were acquired during the first 225 orbits. The preliminary data analysis has shown that ionospheric structure is observed and is significant. Computer programs for processing the flight data have been developed and are discussed. The computer programs have been used to perform detailed surveys of the particle fluxes for some early orbits.
Author (TAB)

N71-10645# Naval Postgraduate School, Monterey, Calif.
HYDROGEN-OXYGEN RELAXATION EFFECTS ON SPACECRAFT OPERATIONS IN THE 70 km TO 100 km ALTITUDE REGION
Michael Thomas Gallagher (M.S. Thesis) Apr. 1970 51 p refs
(AD-710716) Avail: NTIS CSCL 4/1

Hydrogen and oxygen reactions in the earths atmosphere between 70 Km and 100 Km may at times serve as a relaxation mechanism for this region of the atmosphere. Energy stored in this region as a result of intense solar radiation, or energetic particle bombardment, may be rapidly released by hydrogen-oxygen reactions. Such reactions include ion-ion recombination and condensation of supersaturated mixtures of water or hydrogen peroxide vapors in the region. The possible nature of such mechanisms was considered in an attempt to estimate the effects on spacecraft performance in this altitude region. The basic question involved was whether the chemical and kinetic energy stored in hydrogen-oxygen complexes could materially affect spacecraft performance.
Author (TAB)

N71-10603*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TYPE 3 SOLAR RADIO BURST STORMS OBSERVED AT LOW FREQUENCIES. PART 3: STREAMER DENSITY, INHOMOGENEITIES, AND SOLAR WIND SPEED
Joseph Fainberg and R. G. Stone Oct. 1970 28 p refs Submitted for publication
(NASA-TM-X-65374; X-693-70-389-Pt-3) Avail: NTIS CSCL 03B

The analysis of a storm of type 3 solar radio bursts observed in August 1968 between 5 and 0.2 MHz by the RAE-1 satellite yielded the storm morphology, a possible relation to meter and decameter storms, and an average exciter speed of 0.37c between 10 and 40 solar radii. A continuation of the analysis, based on the apparent dependence of burst drift rate on heliographic longitude of the associated active region, now provides a distance scale between plasma levels in the streamer, an upper limit to the scale size of coronal streamer density inhomogeneities, and an estimate of the solar wind speed. By fixing one level the distance scale is utilized to determine the electron density distribution along the streamer between 10 and 40 solar radii. The streamer density is found to be 16 times that expected for the solar minimum quiet solar wind.
Author

N71-10610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY ASTRONOMY, 1
Stephen S. Holt Sep. 1970 38 p refs
(NASA-TM-X-65372; X-661-70-379) Avail: NTIS CSCL 03B

Justification is presented for the theory that observable X-ray emission of high energy photons of extrasolar origin are associated with scale sizes ranging from neutron stars to the entire intergalactic medium. The X-ray band of the electromagnetic spectrum is defined from about 0.1 keV to some few hundred keV. All photons in this energy window are thus classified as X-rays regardless of the mechanism of their origin. With the upper end of this window below the electron rest mass, it is reasonably certain that nuclear processes play no substantial role in the genesis of celestial X-rays.
Author

N71-10708# Army Electronics Command, Fort Monmouth, N.J.
SOLAR-CYCLE DEPENDENCE OF THE IONOSPHERIC ELECTRON CONTENT
Fred B. Daniels May 1970 38 p refs
(AD-711524; ECOM-3292) Avail: NTIS CSCL 4/1

The Faraday rotation of lunar radio echoes was used to measure the ionospheric electron content from the trough to the peak of the current solar cycle. The smoothed average of the daily maximum values is found to be related through a linear regression equation to the smoothed sunspot number. Since the latter is predictable, the former can also be predicted. Diurnal and seasonal changes relative to this smoothed average can be estimated from the plotted diurnal curve corresponding to the sunspot number of interest.
Author (TAB)

N71-10767*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STABILITY OF SUNSPOT MAGNETIC FIELDS AND THE ORIGIN OF SOLAR FLARES
Kunitomo Sakurai Oct. 1970 21 p refs Submitted for publication
(NASA-TM-X-65375; X-693-70-390) Avail: NTIS CSCL 03B

The steady motion in sunspot magnetic regions is considered for both current-free and force-free configurations. The sufficient condition for stability is obtained in the presence of both external current-free and force-free magnetic fields and a steady motion. It is shown that the pattern of such steady motion is most important in triggering an instability of sunspot magnetic fields, both for the current-free and force-free configuration. When there is no steady motion, the current-free configuration of sunspot magnetic fields is always stable, whereas the stability in the case of force-free magnetic fields is connected with the configuration. The onset of a solar flare seems to be associated with an instability connected to the steady motion within the sunspot magnetic regions.
Author

N71-10768*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GENERAL FORMULA FOR ARTIFICIAL ELECTRON DECAY LIFE-TIMES
E. G. Stassinopoulos and P. Verzariu Oct. 1970 13 p refs Submitted for publication
(NASA-TM-X-65376; X-641-70-392) Avail: NTIS CSCL 04A

A treatment based on the analysis of data from Satellite 1963 38C has been developed to calculate the decay lifetimes of the artificial electron belt produced by the Starfish nuclear explosion. The treatment makes use of experimental data and describes the decay life time in the form of a three-dimensional continuum in B, L and energy space. The results are valid over the entire inner zone of the trapped radiation belt. Reference maps of constant decay life time contours in B-L, B-E, and L-E space have been constructed and are discussed.
Author

N71-10789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEARCH FOR TEMPORAL STRUCTURE IN X-RAYS FROM

SCO X-1
E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Oct. 1970 16 p refs
(NASA-TM-X-65377; X-661-70-396) Avail: NTIS CSCL 03B

The temporal behavior was investigated of the X-ray emission from Sco X-1 on 3 March 1969, based upon data obtained over a continuous 122 sec. exposure in the energy range 2 - 20 keV, where the count was recorded each 322 microsec. No evidence was found for any temporal structure in the data. The 5 sigma upper limits on the pulsed fraction at any given period are below 1% for periods in the range 3 - 300 millisec. Upper limits were established for non-periodic variations over times from a fraction of a millisec to about 1 minute. Any continuous X-ray flickering on the scale of seconds is less than 1.2%, which is below the 0.02 mag. flickering level previously observed in the visible. Author

N71-10078# Naval Academy, Annapolis, Md.
THE RESPONSE OF A SPARK CHAMBER TO INCIDENT NEUTRAL PARTICLES
John C. DeJong 15 May 1970 44 p refs
(AD-711287; USNA-TSPR-8) Avail: NTIS CSCL 4/1

The study was carried out to furnish a suitable detector efficiency or response function for the analysis of neutral cosmic particles. A detector response function has been obtained using a digital computer program to simulate the action of the detector. The simulation incorporates the Monte Carlo technique of using random numbers to approximate distributions of physical parameters. The program is flexible. The simulation presently deals with the response to the muon but can easily be expanded to treat as much of the interaction as necessary for further analysis. Seventy-one actual events are available for study and the artificial data derived from the simulation in its present form have correlated in a positive fashion. Author (TAB)

N71-10913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DOSE RESPONSE FUNCTIONS IN THE ATMOSPHERE DUE TO INCIDENT HIGH-ENERGY PROTONS WITH APPLICATION TO SOLAR PROTON EVENTS
John W. Wilson, Jules J. Lambiotte, Jr., Trutz Foelsche, and Tassos A. Filippas Washington Nov. 1970 33 p refs
(NASA-TN-D-6010; L-6947) Avail: NTIS CSCL 03B

The results of a recent high-energy nucleon transport calculation are presented as dose response functions at five altitudes in the atmosphere. The dose in extremities and the dose averaged over the body are directly calculated from these response functions by integration over the incident-energy spectra in the range 0.1 to 10 GeV. A dose-altitude profile is obtained by using all five sets of response functions. A geomagnetic cutoff model for normal magnetic field strengths is also presented. Doses for several solar events of solar cycle 19, including the high-energy event of February 12, 1956, are presented. The present results are compared with other calculations. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-10019# Royal Greenwich Observatory, Herstmonceux (England). Nautical Almanac Office.
THE USES OF OBSERVATIONS OF THE POSITIONS OF THE PLANETS AND NATURAL SATELLITES
G. A. Wilkins Nov. 1969 15 p refs
(NAO-TN-17) Avail: NTIS

The uses of position observations of planets and natural satellites are discussed under three main headings: the testing of fundamental theories, the improvement of the fundamental astronomical coordinate system, and applications to other fields of astronomy. It is concluded that these uses justify the continuance and possible extension of programs for such observations. Author

N71-10051*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PARTICLES AND FIELDS NEAR JUPITER
James N. Warwick Washington NASA Oct. 1970 126 p refs
(Contract NAS7-100)
(NASA-CR-1685) Avail: NTIS CSCL 03B

Data on particles and fields near Jupiter based on interpretations of earth-based observations of radio emissions in the higher frequency ranges are summarized, and elementary physical principles and probable uncertainties in the results are discussed. Jupiter's magnetic field appears to be dipolar, with a moment of value 4.2 x 10 to the 30th power c.g.s., directed at 7.7 deg to the rotation axis. There is evidence for a small quadrupole moment, about 0.06 R sub J in units of the dipole moment. Typical energies for the relativistic electron fluxes are estimated to be 10 MeV, and represent a range of about 3 to 30 MeV. Lower energy electrons are much more difficult to estimate, and proton fluxes are virtually unknown on the basis of available data. However, sensitive upper limits to the thermal plasma density in the magnetosphere were established empirically. Author

N71-10076*# Pennsylvania State Univ., University Park. Materials Research Lab.
SPACE APPLICATIONS OF SOLID STATE LUMINESCENT PHENOMENA
Jon N. Weber and Eugene White, eds. 1970 115 p refs
Workshop held at University Park, Pa., 18 - 19 May 1970
(Grant NGL-39-009-015)
(NASA-CR-111003; MRL-Spec-Publ-70-101) Avail: NTIS CSCL 03B

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WILLEMITE SINGLE CRYSTALS R. J. R. S. B. Bhalla p 71–78 refs (See N71-10085 01-26)

10. THE LUMINOSCOPE: A NEW INSTRUMENT FOR STUDYING THE ELECTRON-STIMULATED LUMINESCENCE OF TERRESTRIAL, EXTRA-TERRESTRIAL AND SYNTHETIC MATERIALS UNDER THE MICROSCOPE L. F. Herzog, D. J. Marshall, and R. F. Babione (Nuclide Corp.) p 79–98 refs (See N71-10086 01-14)

11. LABORATORY STUDIES OF LUMINESCENCE OF ROCKS AND OF NATURAL AND SYNTHETIC INORGANIC MATERIALS J. Dubois (Pau Univ) p 99–104 refs (See N71-10087 01-13)

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N71-10077*# Manchester Univ. (England). Dept. of Astronomy.
LUMINESCENT PHENOMENA ON THE MOON AND IN INTERPLANETARY SPACE
Zdenek Kopal *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 6–21 refs (See N71-10076 01-30)
Avail: NTIS CSCL 03B

Astronomical observations are reviewed which provide clear indications that the Moon exhibits the presence of additional sources of light which is independent of scattering or thermal emission. Spectrophotometric investigations also disclose that the lunar luminous phenomena are transient (they do not always occur in the same place with the same amplitude). Further observations prove that this phenomenon is present whenever solid particles, unprotected by any atmosphere, are exposed to the full impact of solar radiation both electromagnetic and corpuscular. It is concluded that this phenomenon is due to solid state luminescence and solutions are sought from the solid state physics laboratories on the Earth. E.M.C.

N71-10079*# United Kingdom Atomic Energy Authority, Harwell (England).
LOW-TEMPERATURE THERMOLUMINESCENCE OF APOLLO 11 MATERIAL
J. A. Edgington and I. M. Blair *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 29–38 refs Prepared in cooperation with Queen Mary Coll. (See N71-10076 01-30)
Avail: NTIS CSCL 03B

Two samples of Apollo 11 fines were separated in various fractions and their thermoluminescent properties were investigated. Glow peaks and their parameters are tabulated and it is concluded that terrestrial water was adsorbed onto the surfaces of certain mineral phases. The hydrated states act as powerful electron traps and are responsible for the glow peaks. The different glow peaks due to various hydration states of the silicates explains the observed association between trap depth and annealing temperature. The intensities of these water-induced glow peaks are rather large, and suggest a mechanism that is accountable for the transient lunar phenomenon. E.M.C.

N71-10080*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Space Sciences Dept.
LUNAR SAMPLE LUMINESCENCE
Norman N. Greenman and H. Gerald Gross *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 39–48 refs (See N71-10076 01-30)
(Contract NAS9-7966)
Avail: NTIS CSCL 03B

The luminescence of lunar rocks are evaluated by comparing them with similar measurements of terrestrial rocks and minerals. The excitation sources are hose of importance in the space environment, ultraviolet, X-rays, protons, and electrons. The luminescence spectra are measured from 1216 A, or from the exciting wavelength if it is longer than 1216 A to 6000 A. Low luminescence efficiency of the lunar material examined from Apollo 11 lunar samples suggest that other lunar areas, especially in the highlands, could contain rocks of higher efficiency. Therefore, samples from many areas of the moon need to be studied in order to characterize the luminescence of the lunar rocks and to understand its significance. E.M.C.

N71-10081*# Iowa State Univ. of Science and Technology, Ames. Dept. of Nuclear Engineering.
THERMOLUMINESCENCE-CHEMICAL COMPOSITION CORRELATIONS FOR METEORITIC ENSTATITE
Raymond T. Greer *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 49–55 refs (See N71-10076 01-30)
Avail: NTIS CSCL 03B

Relationships between total thermoluminescence output and elemental composition for a single phase, enstatite ($MgSiO_3$), were sought for enstatite chondrite and achondrite meteorite specimens. The total thermoluminescence output of meteoritic enstatite was found to be inversely proportional to the amount of iron in the material and independent of the Ca and Mn. No significant correlation for thermoluminescence intensity was found with respect to cosmic ray exposure ages or natural radioactivity. This compositional dependence for thermoluminescence response indicates severe limitations on using thermoluminescence as a stratigraphic analytical technique for lunar silicate materials. Author

N71-10088*# Pau Univ. (France).
EXISTENCE AND STUDY OF LUNAR LUMINESCENCE
J. Dubois and F. Link *In* Pennsylvania State Univ. Space Appl. of Solid State Luminescent Phenomena 1970 p 105–115 refs (See N71-10076 01-30)
Avail: NTIS CSCL 03B

The agreement reported by several experimenters and methods corroborates the existence of lunar luminescence. Photometric measurements of the eclipsed moon not only demonstrate the lunar luminescence phenomenon but also make it possible to locate the sources of the radiation causing excitation. Author

N71-10151# Royal Radar Establishment, Malvern (England).
RADIO SOURCES AND THE ATMOSPHERE: OBSERVATIONS WITH THE RRE INTERFEROMETER AT 2695 MHz
H. Gent, R. L. Adgie, and J. H. Crowther *In its* RRE Newsletter and Res. Rev., No. 8 1969 3 p refs (See N71-10126 01-34)
Copyright. Avail: NTIS

The atmospheric effects found to occur when operating an interferometer at 2695 MHz are discussed, and radio source positions measurements made in 1968 are described. The changes in the Defford interferometer to operate at this frequency are listed. Phase changes induced by the atmosphere are also discussed. F.O.S.

N71-10194# RAND Corp., Santa Monica, Calif.
TRACKING ERROR PROPAGATION AND ORBIT PREDICTION PROGRAM
R. L. Mobley, L. N. Rowell, and M. C. Smith Jul. 1970 74 p refs
(Contract F44620-67-C-0045)
(AD-711037; RM-6256-PR) Avail: NTIS CSCL 15/3

The report is a description of TEPOP (Tracking Error Propagation and Orbit Prediction Program), a rand-modified FORTRAN IV program used in the AFSC/ADC Joint Mission Analysis on Surveillance of Objects in Space. TEPOP simulates space-vehicle tracking data from as many as 64 sensors. Rand improvements: Sensors may be satellite-based, may rotate, may be limited in azimuth, elevation, and range; drag bias can be included; the JPL

ephemeris tape is used; the program was converted to double-precision. Besides determining a targets path from real data, TEPOP can be used to generate synthetic data for objects orbiting earth, sun, moon, Mars, Venus, or Jupiter, or on an interplanetary course; to study the effects of introducing random and systematic errors; and to generate confidence regions for position and velocity.
Author (TAB)

N71-10230# Royal Radar Establishment, Malvern (England).
THE PRECISE MEASUREMENT OF RADIO SOURCE POSITIONS WITH THE RRE INTERFEROMETER
H. Gent, R. L. Adgie, and J. H. Crowther *In its* RRE Newsletter and Res. Rev., No. 9 1970 2 p (See N71-10201 01-34)
Copyright. Avail: NTIS

Radio astronomy operations are reviewed. Comments are given on interferometer system parameters; source selection declination, flux density, and radio diameter characteristics; planning for source position observation; and measurement accuracy. E.C.

N71-10252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ADVANCED STUDIES: PLANS AND PROGRAMS
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 1–3 (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 22A

The need for lunar roving vehicles in a lunar science program was established on the basis of function, utility, or mission requirements, rather than from fundamental science objectives. Field geology and traverse geophysical experiments are considered for investigating the lunar surface. The techniques and procedures developed for automated lunar exploration are discussed as an initial step towards automated surface operations on all the terrestrial planets. Successful lunar exploration also requires special instrumentation for in situ analysis of mineralogy, texture, and age of surface materials. R.B.

N71-10253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENVIRONMENTAL REQUIREMENTS: PROJECT ENGINEERING DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 4–9 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 03B

Empirical equations for modeling atmospheres of Jupiter and Saturn are derived. The equations give partial vapor pressure over solid NH3, solid (NH3)2H2O hydrate, solid NH3H2O hydrate, solid H2O, and NH3-H2O solution phases. Along boundaries of the regions, equations for freezing curve temperatures are given as a function of concentration. The results agree well with tabular data and with results from previous experiments. The derived relations permit prediction of cloud composition and temperature of formation in a model atmosphere containing ammonia and water required for space vehicle design criteria. R.B.

N71-10268*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND ORBIT DETERMINATION: MISSION ANALYSIS DIVISION
In its Space Programs Summary 37-64, Vol. 3 31 Aug. 1970 p 162–169 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 22C

Analytic expressions for the partial derivatives of observables with respect to the Robertson's relativistic parameters are presented. The results of quantitative confirmation of planetary defects in the lunar theory by spectral decomposition are also reported. R.B.

N71-10291*# Tetra Tech, Inc., Pasadena, Calif.
PROBING THE SOLAR CORONA WITH SPACECRAFT RADIO SIGNALS
W. Wells, R. Marquedant, and H. Hodara Washington NASA Oct. 1970 159 p refs
(Contract NAS1-9167)
(NASA-CR-1655; TC-163) Avail: NTIS CSCL 03B

Review of present knowledge of the corona shows that the region near the sun (a few solar radii) and the direction out of the ecliptic plane should be probed. Large scale density and velocity structure should be studied, and an attempt made to see whether the solar wind originates in small disturbances or large areas of the sun's surface. Radio links were analyzed as were the connections between measurable radio parameters and their information content regarding the corona, its structures, and parameters. The use of two microwave carrier frequencies is recommended, probably S- and X-band, but no lower than S-band. An uplink propagation experiment (like the Stanford Pioneer 7) followed by data reduction on the spacecraft and downlink telemetry is preferable to insure reception with a strong signal-to-noise ratio. However, factors beyond the scope of this study could alter this conclusion in favor of a downlink, which greatly simplifies the craft and gives raw data at multiple ground stations. A passive attitude control scheme for spin-stabilized spacecraft is recommended for this mission. The spin axis points stably toward the sun, but lags slightly in following the sun's apparent angular movement. Sun sensors can give instantaneous roll angle if this information is desired. The required torque derives from solar pressure acting on vanes that are fixed with respect to the craft. Author

N71-10296*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CONTROL AND USE OF LIBRATION-POINT SATELLITES
Robert W. Farquhar Washington Sep. 1970 129 p refs
(NASA-TR-R-346) Avail: NTIS CSCL 22C

Satellite station keeping in the vicinity of unstable collinear libration points is examined. Simple linear feedback control laws are formulated, and stability conditions are determined for both constant and periodic coefficient systems. It was found that stability could be achieved with a single-axis control that used only range and range-rate measurements. The station-keeping cost with this control is given as a function of the measurement noise. If earth-based measurements are available, this cost is very low. Other control analyses include solar sail control at the earth-moon collinear points and a limit-cycle analysis for an on-off control system. Several possible libration-point missions are proposed. It is suggested that libration points could be utilized for lunar far-side communications, lunar and interplanetary transportation systems, deep space optical communications, and monitoring solar-induced phenomena in and beyond the earth's magnetosphere. Author

N71-10319*# Carnegie-Mellon Univ., Pittsburgh, Pa.
A UNIVERSAL MAGNITUDE SYSTEM FOR ASTRONOMICAL OBJECTS
Truman P. Kohman *In its* Nucl. Chem. and Geochem. Res. 30 Jun. 1970 p 110–111 Presented at meeting of the Am. Astron. Soc., Boulder, Colo., 10 Jun. 1970 Submitted for publication (See N71-10304 01-08)
Avail: NTIS CSCL 03A

The great variety of magnitude scales in use in astronomy is confusion, partly because of their arbitrariness, and particularly because of the lack of a logical relationship between the scales for different quantum energies. A universal system of magnitudes based on power flux is proposed. This proposal is based on the concept of the expression of spectral (monochromatic) power flux as the logarithmic derivative with respect to any spectral parameter.
Author

N71-10362# Observatoire de Paris (France).
POLARIMETRIC PROPERTIES OF THE LUNAR SURFACE AND ITS INTERPRETATION. PART 2: TERRESTRIAL SAMPLES Final Report
Audouin Dollfuss, Edward Bowell, and Chilot Tasisse 20 May

1970 50 p refs
(Contract AF 61(052)-914)
(AD-711070; AFCRL-70-0441-Pt-2) Avail: NTIS CSCL 3/2

For the interpretation of lunar polarisation measurements, samples were measured in the laboratory, using orange light of a wavelength of 6000 A. In all 61 samples were used, representing a wide variety of meteorites, volcanic ashes, basalts and other rocks. 31 samples have been seived into 4 grain size groups, with average grain sizes ranging from 160 micrometers down to 26 micrometers. Both the maximum degree of polarisation and the normal albedo are dependent of the grain size. The lunar data indicate a linear correlation between the log of the normal albedo and the log of the maximum degree of polarisation. The meteorites and the terrestrial samples are different, except for the two measured bronzide-chondrites and the fine-grained basalts. It is shown that several physical processes (i.e. upwelling, proton darkening, diminution of grainsize and surface compaction) have a bearing upon the normal albedo and the degree of polarisation.
Author (TAB)

N71-10365# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ESTIMATES OF MAGNITUDES OF THE BRIGHTEST STARS IN THE CLUSTERS OF THE LARGE-MAGELLANIC CLOUD
Paul W. Hodge, Gary A. Welch, Russell Wills, and Frances W. Wright 14 Aug. 1970 39 p refs
(Grant NSF GP-7987)
(SAO-Special-Rept-320) Avail: Issuing Activity

To obtain an idea of the distribution of ages of the star clusters belonging to the Large Magellanic Cloud, estimates have been made of the magnitudes of the brightest main-sequence stars of most of the 1604 known clusters. Magnitude data are presented for a majority, and upper limits of the brightnesses of the remaining clusters are estimated.
Author

N71-10385*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH RELATED TO MEASUREMENTS OF ATOMIC SPECIES IN THE EARTH'S UPPER ATMOSPHERE Final Report
Bernard J. Wood, Bill R. Baker, and Henry Wise Jun. 1970 92 p refs
(Contract NASr-49(30); SRI Proj. PGU-6682)
(NASA-CR-111117) Avail: NTIS C3CL 04A

The kinetics of interaction of atomic oxygen and atomic hydrogen on surfaces of gold, silver, titanium, stainless steel, and aluminum were studied to obtain accurate mass spectral data from satellite-born mass spectrometer. An ultrahigh vacuum system consisting of a cylindrical reaction vessel was employed in which the total gas pressure and the entering flux of atoms were held constant. Atoms were generated at the inlet of the reactor by thermal dissociation of oxygen or hydrogen on a hot tungsten ribbon. The flux of atomic species that survived transit through the reactor was determined by a mass spectrometer with its ion source adjacent to the reactor outlet. The relative rate of atom loss on a particular surface was evaluated by observing the diminution in atom flux at the outlet when a specimen of the material of interest was inserted into the reactor. The experimental results generally agree with data reported by the OGO-F satellite mass spectrometer with a gold-plated antechamber.
Author

N71-10387# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
LOSS DUE TO MISSING DATA IN EFFICIENCY OF A LOCALLY OPTIMAL TEST FOR HOMOGENEITY WITH RESPECT TO VERY RARE EVENTS
Prem S. Puri Aug. 1970 19 p refs Submitted for publication Prepared in cooperation with California Univ., Berkeley *Its* Mimeograph Ser. No. 234
(Grants Nonr-1100(26); NIH GM-10525-07)
(AD-710755) Avail: NTIS CSCL 12/1

With reference to observations of supernovae in galaxies, a locally optimal test for the hypothesis of homogeneity of the observational units with respect to occurrence of supernovae (treated as a very rare event) is obtained for the case where the data are available only for those galaxies where at least one supernova is observed. It is shown that the loss in the asymptotic efficiency of the test due to lack of reporting of galaxies with no supernovae is very heavy and in fact is infinite for the case of very rare events.
Author (TAB)

N71-10477# Royal Greenwich Observatory, Herstmonceaux (England).
LINE INTENSITIES IN THE VISUAL REGION OF MU CASSIOPEIAE
R. M. Catchpole, B. E. J. Pagel, and A. L. T. Powell 1969 18 p refs Prepared in cooperation with Royal Obs., Cape Town, South Africa *Its* Bull. No. 154
Avail: Sci. Res. Council, London: 6s

Listed are equivalent widths and other relevant data for spectral lines of the mild subdwarf mu Cassiopeiae measured on four Palomar coude exposures in the visual region taken by Dr. J. L. Greenstein in 1963. The analysis of the data has been published elsewhere.
Author

N71-10494# Colorado Univ., Boulder.
MODELS FOR MAGNETOFLUID DYNAMICS OF THE SUN Final Report, 15 Jun. 1967 – 15 Jun. 1970
Peter A. Gilman 15 Jun. 1970 17 p refs
(Contract F19628-67-C-0304)
(AD-710629; AFCRL-70-0260) Avail: NTIS CSCL 3/2

The report summarizes a number of theoretical models developed for: (a) Baroclinic and Rossby waves in magnetic fields, and Rossby wave dynamos; (b) Interaction of thermal convection with rotation and shear flow; (c) Magnetic buoyancy instabilities. These models elucidate mechanisms for the maintenance of solar differential rotation and large-scale magnetic fields.
Author (TAB)

N71-10544# Naval Postgraduate School, Monterey, Calif.
SINGULAR PERTURBATION PROBLEMS IN EARTH-MOON SPACE
Vernon Curtis Gordon (M.S. Thesis) Jun. 1970 75 p refs
(AD-710729) Avail: NTIS CSCL 3/3

A program was written for the IBM 360 system of the Naval Postgraduate School Computer Facility to apply the methods of singular perturbation theory to earth-moon trajectories. Verification of results against previous work was carried out and it was found that agreement could be attained only for energy parameter values of 0.707 or less. No solution for higher values could be found. The analysis of three dimensional orbits was then conducted within this restricted range to show the merit of singular perturbation theory as an initial design tool.
Author (TAB)

N71-10576*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE-TRACKING PROGRAM Semiannual Progress Report, 1 Jan. – 30 Jun. 1970
30 Jun. 1970 32 p refs
(Grant NGR-09-015-002)
(NASA-CR-111128; SAO-008-69; SAPR-22) Avail: NTIS CSCL 22C

The completion of calculations is reported for the 1969 Smithsonian Standard Eart (2), which represents a culmination of over a decade of satellite observations. New models of the upper atmosphere that take into account the latest data from mass spectrometers on rockets and satellites and from thermosphere probes, measurements of EUV absorption, and data on satellite drag observed over a complete solar cycle were completed.
Author

N71-10579# National Bureau of Standards, Washington, D.C.
SPECTRUM FORMATION IN STARS WITH STEADY-STATE EXTENDED ATMOSPHERES Proceedings of the International Astronomical Union Colloquium No. 2, Commission 36
H. G. Groth, ed. (Univ.–Sternwarte Müenchen) and P. Wellmann, ed. (Univ.–Sternwarte Muenchen) Aug. 1970 342 p refs Conf. held at Munich, 16–19 Apr. 1969
(NBS-SP-332) Avail: SOD $1.75 Catalog No. C13.10:332

A symposium on spectrum formation in extended stellar atmospheres was held 16–19 April, 1969. A major problem was the definition of what is meant by an extended stellar atmosphere. The question of specific definitions in various kinds of objects was discussed. Attention focused mainly on the type spectrum to be expected in various situations. The spectral features to be expected in both static and dynamic atmospheres, including and excluding departures from LTE, were discussed. The symposium was divided into four sections: (1) type of problems which exist; (2) theoretical methods for handling non-LTE problems; (3) chromospheres and coronae of stars; and (4) summary. The mms of the formal papers that were presented plus an edited and abridged version of the discussions following each paper are included. Author

N71-10583*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR ACTIVITY AND PLANETERY LUMINOSITY
V. K. Balasubrahmanyan and D. Venkatesan (Calgary Univ., Alberta). Oct. 1970 21 p refs Submitted for publication
(NASA-TM-X-65373; X-661-70-380) Avail: NTIS CSCL 03B

The Chree superposition analysis of the luminosities of the planets Jupiter, Saturn, Uranus, and Neptune indicates a correlation between solar activity and planetary luminosity. The variations of the solar constant in the visible range are considered to be too small to explain the observed changes in brightness. It is concluded that the interaction of solar extreme ultraviolet or solar wind particles with the atmospheres of these planets is probably responsible for the increased albedo during periods of high solar activity. Author

N71-10726* Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THE STABILITY OF MOTION OF SATELLITES WITH FLEXIBLE APPENDAGES Semiannual Technical Progress Report, 1 Apr.–30 Sep. 1970
Leonard Meirovitch Sep. 1970 38 p refs
(Grant NGR-36-004-042)
(NASA-CR-111143; STPR-2) Avail: NTIS CSCL 22C

The stability of motion of a satellite consisting of a main rigid body and three pairs of flexible booms, coinciding with the principal axes of the body in undeformed state, is under consideration. The problem formulation is a hybrid one, in the sense that some of the generalized coordinates depend on time alone and the other depend on spatial position and time. The problem is transformed into a discrete one by means of modal analysis. The motion stability is investigated by Liapunov second method. A computer program has been written and the numberical results are displayed in the form of stability diagrams using the system properties as parameters. Author

N71-10727*# Computer Sciences Corp., Silver Spring, Md.
DIFFERENTIAL CORRECTION METHODS IN SPACECRAFT ATTITUDE DETERMINATION
John P. Crocker 17 Jun. 1968 148 p refs
(Contract NAS5-9758-28)
(NASA-CR-111148; WD-9758-21-2) Avail: NTIS CSCL 22C

Specific questions arising the application of least squares differential correction to the problem of spacecraft attitude determination are dealt with. The attitude determination problem is stated as a least squares problem in several variables to which the method of differential correction is applied. The mathematical principles involved are identified and the correct variables are chosen and discussed. Author

N71-10731# Air Force Cambridge Research Labs., Bedford, Mass.
STELLAR STANDARDS AT 10 MICRONS
Stephan D. Price 13 Jul. 1970 18 p refs /ts AFCRL-AFSIG-221
(AD-711364; AFCRL-70-0402) Avail: NTIS CSCL 3/2

There is a need for reliable 10 micrometer standards with which to reference the background measurements being done by various Air Force user groups. A literature search was conducted to compile a list of non-planetary celestial sources which have fluxes greater than 5 times 10 to the (-17)th power W per (micrometer (cm, squared)) at 10 micrometers. Standard stars are chosen from the list and recommended flux values are assigned to them. Author (TAB)

N71-10827# Yeshiva Univ., New York. Belfer Graduate School of Science.
QUANTUM SPACE-TIMES AND GENERAL RELATIVITY
David Finkelstein 21 Aug. 1968 6 p refs Presented at the Rosen Symp., Haifa, Israel, 1969 Sponsored in part by NSF
Avail: NTIS

Considered are modifications to general relativity in order to overcome the divergency problem of quanqum field theory by introducing a quantum theory of space-time. The quantum of space-time, the chronon, is developed for a convergence theory by directly formulating physical theories in digital computer language. The world is considered to be a digital computer where physical events are computational events, and the causal relation which defines most of its structure is a relation of structural dependence. Conceptual changes suggested by general relativity in this world scheme are developed in general computers whose flow charts are self-modified during computation and thus infer a conditional, self-influencing causal structure. It is concluded that if the world is a digital computer than the world computer must be a general asynchronous quantum mechanical digital computer. G.G.

N71-10841# Stanford Univ., Calif. Inst. for Plasma Research.
A MODEL OF PULSARS
P. A. Sturrock May 1970 84 p refs
(Contract F44620-69-C-0008)
(AD-711397; SU-IPR-365) Avail: NTIS CSCL 3/2

The model comprises a rotating neutron star (R approximately 1,000,000 cm) with a strong magnetic field (B approximately 10 to the 12th power gauss). Magnetic field lines which reach the light cylinder are open field lines which connect to the surface of the star at the polar caps. Each polar cap contains two zones, an electron polar zone (EPZ) and a proton polar zone (PPZ) from which electrons and protons, respectively, stream from the star. Acceleration of each stream is effected close to the surface of the star. The optical, x-ray and gamma-ray flux expected from a model of the Crab pulsar can be reconciled with observation if the rotation axis, dipole axis, and line of sight are so related that radiation is received from the PPZs but none from the EPZs. TAB

N71-10936*# Scientific Translation Service, Santa Barbara, Calif.
OBSERVATIONS OF JUPITER, VENUS, AND SOURCE 3C 273 AT 2 AND 8 mm WAVELENGTHS [NABLYUDENIYA YUPITERA, VENERY I ISTOCHNIKA 3S 273 NA VOLNAKH 2 I 8 MM]
V. A. Yefanov et al Washington NASA Nov. 1970 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorki), v. 13, no. 2, 1970 p 219–224
(Contract NASw-2035)
(NASA-TT-F-13383) Avail: NTIS CSCL 03B

A description is given of the observational results obtained in May 1968, on the 22 meter radio telescope of the Crimean Astrophysical Observatory of the USSR Academy of Sciences. The brightness temperature of Venus was found to equal 280 + or – 25 K at wavelength = 2.16 mm and 495 + or – 20 K at

wavelength = 8 mm by making comparisons with Jupiter. The data were reduced without allowance for errors in determining brightness temperatures of Jupiter, which were assumed to equal 150 + or − 20 K at wavelength = 1.6 mm and 144 + or − 20 K at wavelength = 8 mm. Author

N71-10957# Rice Univ., Houston, Tex.
THEORETICAL ASTROPHYSICS: A RESEARCH PROGRAM AT RICE UNIVERSITY Final Report, 1 Feb. 1968 −31 Jul. 1970
Donald D. Clayton 21 Sep. 1970 11 p refs
(Grant NSF GP-8174)
Avail: Issuing Activity

The nuclear data concerning the proposition that the chemical elements were created by nuclear reactions in stars was studied in the explosion of stars. It is shown that in a large evolved star, concentric zones of differing composition exist. When a central explosion occurs, an outward moving pressure wave heats the surrounding layers and causes them to undergo extensive modification. The elements that arise from the various zones are given. Abstracts of the papers written on this research are included. F.O.S.

N71-10973# Office of Science and Technology, Washington, D.C.
THE NEXT DECADE IN SPACE A Report of the Space Science and Technology Panel of the President's Science Advisory Committee
Lee A. DuBridge GPO Mar. 1970 68 p refs
Avail: SOD $0.65

The goals and recommended programs in space for the next decade are presented. Included in the program goals are the following: (1) Contribute to the economic strength and security of the Nation and provide beneficial services through an expanded program of earth-oriented research and applications of space science and technology. (2) Explore the solar system, with emphasis on a phased program of lunar exploration, the search for extraterrestrial life and a diversified program of planetary exploration. (3) Develop new technologies in automatic remote control systems, and reduce the cost of access to and operations in space. The emphasis should be on reaping rewards in terms of basic new scientific knowledge and applications of value to man's life on earth. F.O.S.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-10101*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT TEST RESULTS PERTAINING TO THE SPACE SHUTTLECRAFT SYMPOSIUM PAPERS
Washington Oct. 1970 164 p refs NASA Symp. held at Edwards, Calif., 30 Jun. 1970
(NASA-TM-X-2101) Avail: NTIS CSCL 22B

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10. RATIONALE FOR PROPOSED FLYING-QUALITIES SPECIFICATIONS E. C. Holleman p 127−145 refs (See N71-10111 01-31)

11. FINAL REMARKS AND FUTURE PLANS M. O. Thompson p 147−151 (See N71-10112 01-31)

N71-10102*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
BACKGROUND AND CURRENT STATUS OF THE LIFTING BODY PROGRAM
John T. McTigue *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 1−10 (See N71-10101 01-31)
Avail: NTIS CSCL 22B

The scope and specific objectives of a program to determine the feasibility of conventional lifting bodies for space shuttle systems are outlined. Three vehicles are considered for the program and include the X-24A, the M2-F3, and the HL-10. The significance of technology gained through previous tests of the three vehicles is discussed and the status of current research is given. D.L.G.

N71-10103*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
STABILITY AND CONTROL DERIVATIVES OF THE LIFTING BODY VEHICLES
Robert W. Kempel, Larry W. Strutz, and Paul W. Kirsten (AF Flight Test Center) *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 11−27 refs (See N71-10101 01-31) NTIS CSCL 22B

The important longitudinal and lateral-directional aerodynamic stability and control derivatives obtained from flight are compared with small and full scale wind tunnel results. Significant trends and important differences are pointed out, and the implications discussed. Author

N71-10104*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
ASSESSMENT OF LIFTING BODY VEHICLE HANDLING QUALITIES
John A. Manke, John P. Retelle (AF Flight Test Center), and Robert W. Kempel *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p29−41 (See N71-10101 01-31) NTIS CSCL 22B

The general behavior of three types of lifting bodies in flight is described in broad terms, and some specific examples of behavior that may be of special interest from the pilot's viewpoint are presented. In addition, comments are offered concerning simulation requirements. Author

N71-10106*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

PERFORMANCE CHARACTERISTICS OF THE LIFTING BODY VEHICLE

Jon S. Pyle and Lawrence G. Ash (AF Flight Test Center) *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 43–58 refs (See N71-10101 01-31)

Avail: NTIS CSCL 22B

The lift and drag data obtained in flight for three lifting body vehicles are compared with wind tunnel measurements obtained on the actual flight vehicles and on small scale models of the flight vehicles. In addition, separated flow problems and effects of ablated surfaces are discussed. Author

N71-10108*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

CORRELATION OF FLIGHT-TEST LOADS WITH WIND-TUNNEL PREDICTED LOADS ON THREE LIFTING BODY VEHICLES

Ming H. Tang *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 59–72 refs (See N71-10101 01-31)

Avail: NTIS CSCL 22B

The preliminary results of aerodynamic load studies are presented. Flight loads were measured on the fins and control surfaces of three lifting body vehicles. Because of the flow around the forebodies of the vehicles, the outboard-fin load coefficient at zero angle of attack, sideslip, and control surface deflection and the outboard-fin load coefficient due to the angle of attack were found to be the largest contributors to the overall fin load. These components were accurately predicted by wind tunnel tests. The correlation between flight and wind tunnel hing moments was also found to be generally good. D.L.G.

N71-10107*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

PILOT IMPRESSIONS OF LIFTING BODY VEHICLES

William H. Dana and J. R. Gentry (AF Flight Test Center) *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 73–88 (See N71-10101 01-31)

Avail: NTIS CSCL 22B

Piloting aspects of three lifting body vehicles are discussed. The subjects discussed include: (1) approach, landing, and energy management considerations; (2) field of view requirements; (3) stability considerations; and (4) vehicle riding qualities, including the effects of turbulence. Remarks pertinent to the various subject areas are made by the pilots assigned to the program. Author

N71-10105*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

SUMMARY OF PRIMARY RESULTS OF THE LIFTING BODY PROGRAM

Garrison P. Layton, Jr. *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 89–97 (See N71-10101 01-31)

Avail: NTIS CSCL 22B

A summary of the results that have a bearing on the design of a large space shuttle vehicle are presented. The initial program objectives, the primary program results, and the pertinence of these results to the shuttle are outlined, as well as the future direction of the program. Author

N71-10109*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

APPROACH AND LANDING STUDIES

Berwin M. Kock and Fitzhugh L. Fulton, Jr. *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 99–106 (See N71-10101 01-31)

Avail: NTIS CSCL 22B

The application of approach and landing studies to the proposed space shuttle are discussed. The studies were conducted basically in two areas: powered approach with the HL-10 vehicle, and unpowered approach with B-52 and CV-990 aircraft. It was concluded that: (1) Limited duration propulsion systems used to shallow the approach angle produce few benefits and many disadvantages. (2) Unpowered types of approaches are feasible with large vehicles. D.L.G.

N71-10111*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

RATIONALE FOR PROPOSED FLYING-QUALITIES SPECIFICATIONS

Euclid C. Holleman *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 127–145 refs (See N71-10101 01-31)

Avail: NTIS CSCL 22B

The preliminary results of a program to review the applicability of flying qualities experience to the shuttle mission are presented. The results indicate that much of the experience is applicable to the shuttle if the mission phase and control requirements are considered. D.L.G.

N71-10112*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT TEST RESULTS PERTAINING TO THE SPACE SHUTTLECRAFT: FINAL REMARKS AND FUTURE PLANS

Milton O. Thompson *In its* Flight Test Results Pertaining to the Space Shuttlecraft Oct. 1970 p 147–151 (See N71-10101 01-31)

Avail: NTIS CSCL 22B

A discussion is given on the significance of information and technology gained from space shuttle system studies. The application of the results of these studies to engineering and design aspects of the shuttle system are reviewed and recommendations are made for future research. D.L.G.

N71-10191# Royal Aircraft Establishment, Farnborough (England).

POSSIBLE PAYLOAD TRANSPORT INTO THE 24-h-ORBIT OF THE EUROPA 2 ROCKET AND SOLAR-ELECTRIC PROPULSION MODULE [MOEGLICHKEITEN DES NUTZLASTTRANSPORTES IN DIE 24-h-BAHN MIT DER EUROPA 2 UND SOLAR-ELECTRISCHEM ANTRIEBSMODUL]

W. Rasch et al Feb. 1970 31 p refs Transl. into ENGLISH from German report FB-68-83

(RAE-LIB-Trans-1449; FB-68-83) Avail: NTIS

It is suggested that using a solar electric propulsion module the payload capacity of the Europa 2 rocket may be increased from 170 kg to more than 500 kg. The optimum layout of the thruster was determined for a minimum transfer time, and existing electrostatic thrusters are analysed. This satellite is able to transmit three VHF programs which may be received all over Europe by means of inexpensive pocket transistor sets. Author

N71-10485*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

PAST AND PRESENT MANNED SPACECRAFT ELECTRONICS AND IMPLICATIONS FOR THE SPACE SHUTTLE

R. A. Gardiner and G. Xenakis Nov. 1970 51 p Presented at the 21st Intern. Astronaut. Congr., Constance, Ger. Federal Rep. 4–10 Oct. 1970

(NASA-TM-X-58054) Avail: NTIS CSCL 22B

The objective of the report is to compare the electronic systems used in manned spacecraft on a subsystem basis and to consider any apparent trends or unique characteristics in the contex of the known requirements for the space shuttle. The spacecraft considered are the Mercury, the Gemini, the Apollo lunar module, and the Apollo command and service module. Discussions include the weight of each electronic subsystem and avionic characteristics and trends. Implications for the shuttle are briefly discussed. Author

N71-10582* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPACECRAFT SEPARATION SYSTEM FOR SPINNING VEHICLES AND/OR PAYLOADS Patent
Seymour Selmirs and Otis J. Parker, inventors (to NASA) Issued 22 Nov. 1966 (Filed 4 May 1965) 7 p Cl. 102-49
(NASA-Case-XLA-02132; US-Patent-3,286,630; US-Patent-Appl-SN-453227) Avail: US Patent Office CSCL 22B

A technique is described in which the despin mechanism of one spacecraft stage is used to separate the stages and tumbling of one stage with respect to another. The mechanism is for a spinning vehicle having an upper and lower stage in juxtaposition joined by balls. E.C.

N71-10614*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 13 MISSION: CRYOGENIC OXYGEN TANK 2 ANOMALY REPORT
Jul. 1970 101 p *Its* Anomaly Rept. No. 1
(NASA-TM-X-66462; MSC-IN-02545) Avail: NTIS CSCL 22A

The loss of the cryogenic oxygen tank pressure during the Apollo 13 flight was investigated in two aspects: cause of the flight failure of cryogenic oxygen tank 2, and contributing factors during the ground history of the tank. Pertinent flight data is presented and analyzed. Preflight contributing effects are also presented. It is concluded that: (1) The detanking problem which occurred during the countdown demonstration test resulted from loose or misaligned plumbing components within the tank. (2) Both heater thermal switches failed closed from heater operation during the special detanking. This allowed continuous heater power to be applied, and led to severe damage of the insulation on the power wires leading to a fan motor. (3) A fire was started by electrical short-circuits in the wiring to the fan motors inside oxygen tank 2, after the fan circuits were energized for the seventh time. Corrective actions are included. F.O.S.

N71-10639*# General Electric Co., Philadelphia, Pa.
APPLICATIONS TECHNOLOGY SATELLITE, ATS F AND G, PHASE B AND C Final Report
3 Dec. 1969 154 p refs
(Contract NAS5-11608)
(NASA-CR-111139; DOC-69SD4369) Avail: NTIS CSCL 22B

The experiments and operational objectives of ATS 7 are described. The discussion includes system analysis and tradeoffs, spacecraft subsystems, and Phase C development. The satellite is designed to demonstrate the feasibility of a 30-foot deployable spacecraft antenna with good RF performance up to 10 GHz, provide spacecraft fine pointing and slewing, demonstrate precision interferometer attitude measuring technology for closed loop servo performance, demonstrate the capability of forming high gain, steerable antenna beams, demonstrate the capability of providing RF links from ground to ATS 7 to low orbiting spacecraft and return, provide a communications subsystem for PLACE, data relay, and ITV experiments, and to provide oriented stable spacecraft at synchronous altitude. R.B.

N71-10747* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND MEANS FOR DAMPING NUTATION IN A SATELLITE Patent
Manfred E. Kuebler, inventor (to NASA) Issued 4 Oct. 1966 (Filed 12 Jun. 1962) 6 p Cl. 343-705
(NASA-Case-XMF-00442; US-Patent-3,277,486; US-Patent-Appl-SN-202030) Avail: US Patent Office CSCL 22A

A system is described which provides a flexible turnstile-type antenna system for use in a spin-oriented satellite, the antenna mass extension serving to despin the satellite and the flexibility of the antenna being employed to damp satellite nutation after injection into orbit. The flexible antenna has the desired electrical characteristics and a high hysteresis. Nutational motion of the satellite causes the extended wires to oscillate, which damps out both the nutation and the wire oscillation. The energy dissipation rate can be increased by adding tip weights to the antenna wires without any increase in weight. R.B.

N71-10750# Houston Univ., Tex. Cullen Coll. of Engineering.
A PROBLEM IN OPTIMAL REORIENTATION OF ASYMMETRIC SPACE VEHICLES
Charles Landess Morefield and Bart Childs Aug. 1969 40 p refs
Contract N00014-68-A-0151; Proj. Themis)
(AD-710788; Themis-RE-10-69) Avail: NTIS CSCL 22/1

The problem of large-angle, three-dimensional reorientation of asymmetric space vehicles in a fuel optimal manner is considered. A general problem is posed and solved numerically. The resultant numerical data is compared to a feedback configuration derived from a subset of the general problem. In both instances, Pontryagin's Minimum Principle is utilized to determine the set of differential equations which describe the optimal trajectory. The control is presumed to be unconstrained, resulting in a continuous optimal control. Author (TAB)

N71-10839*# Fairchild Hiller Corp., Germantown, Md.
ATS F AND G (PHASES B AND C), VOLUME 1 Final Report
17 Oct. 1969 464 p refs
(Contract NAS5-11609)
(NASA-CR-111149; ATS-910-012-Vol-1) Avail: NTIS CSCL 22B

The design parameters and program objectives of the Applications Technology Satellites 7 and 8 are summarized. Among the programs discussed are systems engineering, the structural subsystem, the thermal control subsystem, the prime focus feeds, the attitude control subsystem, the interferometer, the commandable gravity gradient subsystem, the auxiliary propulsion subsystem, the telemetry and command subsystem, the electrical power subsystem, the harness subsystem, the radio beacon experiment, ground support equipment, and test plans. See also N71-10840. R.B.

N71-10840*# Fairchild Hiller Corp., Germantown, Md.
ATS F AND G (PHASES B AND C), VOLUME 2 Final Report
17 Oct. 1969 473 p refs
(Contract NAS5-11609)
(NASA-CR-111150; ATS-910-012-Vol-2) Avail: NTIS CSCL 22B

The design objectives of the attitude control subsystem for Applications Technology Satellites 7 and 8 are: to demonstrate the feasibility of a deployable 30-foot parabolic antenna useful to 10 GHz, to demonstrate a spacecraft attitude control capability for directing the antenna beam to any point on the earth's surface, to provide a stable oriented platform at synchronous attitude for advanced technology experiments, to demonstrate a minimum two-year life capability for a spacecraft of the ATS 7 and ATS 8 size and complexity, and to demonstrate orbit repositioning and stationkeeping control in synchronous orbit required for communication and navigation aid purposes. The requirements imposed on the attitude control subsystem, a description of the functional operation of the subsystem, and the degree to which the subsystem meets the requirements are summarized. See also N71-10839. Author

N71-10925*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPOSITION OF ION THRUSTER EFFLUENTS ON SERT 2 SPACECRAFT SURFACES
J. V. Staskus and Robert J. Burns Washington Nov. 1970 21 p refs
(NASA-TM-2084; E-5805) Avail: NTIS CSCL 22A

A method is presented for predicting the characteristics

of an interaction produced by an externally generated, oblique shock wave that impinges on either laminar or turbulent boundary layers. The basis of the method is the assumption that the boundary layer in the interaction region may be divided into two layers: the outer layer, an essentially inviscid but rotational layer, and the inner layer, an essentially viscous layer. Coupling of the inner and outer flows throughout the interaction region is discussed. The only empirical information required for using the method is the extent of upstream propagation of the pressure rise. Correlations for the length of upstream influence, based on parameters consistent with the two-layer hypothesis, are presented. Results predicted by the method are compared with experimental results in terms of surface pressure distributions, heat transfer, and flow-field configuration (i.e., shock-wave structure and regions of compression and expansion). Author

N71-10027* # Translation Consultants, Ltd., Arlington, Va.
SCIENTIFIC RESULTS OF THE FLIGHT OF THE YANTAR AUTOMATIC IONOSPHERIC LABORATORY. PART 3 [NAUCHNYYE REZULTATY POLETOV AVTOMATICHESKIKH IONOSFERNYKH LABORATORIY YANTAR, CH. 3]
G. L. Grodzovskiy et al Washington NASA Nov. 1970 25 p refs Transl. into ENGLISH from Proceedings of 21st Intern. Astronautical Congr. (Constance), 4 - 10 Oct. 1970 28 p
(Contract NASw-2038)
(NASA-TT-F-13403) Avail: NTIS CSCL 22B

Geophysical rockets were used at altitudes of 100-400 km to launch the Yantar automatic ionospheric laboratory with gaseous plasma ion engines to investigate the possibilities for controlled flight in the upper layers of the atmosphere. The work of the gaseous plasma ion engines, which operated on argon, nitrogen and air, was studied under flight conditions in the ionosphere. The parameters describing the interaction of the ion jet and the ionospheric plasma, and the parameters of the neutral atmosphere were measured. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-10007# Rome Univ. (Italy). School of Aerospace Engineering.
CURRENT AEROSPACE STRUCTURAL PROBLEMS [I PROBLEMI ATTUALI DELLE STRUTTURE AEROSPAZIALI]
Paolo Santini 1969 21 p refs In ITALIAN; ENGLISH summary
Avail: NTIS

Progress made in the development of solutions for structural problems is discussed, with particular attention devoted to numerical methods. Problems of the random vibrations and structural optimization are also mentioned. Structural materials are summarized. Author

N71-10023# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Fluid Dynamics Facilities Research Lab.
THE ANISOTROPIC EQUIVALENT OF THE LOVE LONGITUDINAL WAVE PROPAGATION APPROXIMATION Final Report
Marion G. Pottinger Apr. 1970 29 p refs
(AD-710596; ARL-70-0064) Avail: NTIS CSCL 13/13

The anisotropic equivalent of the Love approximation for propagation of longitudinal waves in an isotropic, elastic bar has been derived. Its application including errors is discussed. It implies that the effect of cross-section geometry on dispersion is the same for isotropic and anisotropic bars. It suggests that a relationship termed the Pseudo-Poissons ratio may be useful in classifying dispersion in anisotropic bars. Application to two composite material examples illustrates the drastic effect of fiber orientation on dispersion. Author (TAB)

N71-10036# Communications Research Centre, Ottawa (Ontario).
ELASTIC STABILITY AND EQUILIBRIUM CONFIGURATION OF EARTH POINTING SATELLITES WITH LONG APPENDAGES
F. R. Vigneron and T. Garrett Nov. 1969 24 p refs
(CRC-1206) Avail: NTIS

The elastic stability of the booms on a gravity gradient stabilized Alouette type satellite is investigated to determine the critical lengths above which the booms will take on large deflections under the influence of the gravitational and centrifugal force fields. If the booms are not structurally damaged by the large deflections, the satellite may take up one of several stable configurations. A criterion involving the boom lengths is derived for the stability of the gravity gradient orientation for zoom boom deflections. The derivation includes the flexibility of the booms. Author

N71-10040# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
NONLINEAR STRESS-WAVE PROPAGATION IN A SOIL COLUMN
Ralph Lachenmaier CRREL Jun. 1970 80 p refs
(Contract DA-27-021-AMC-20(X))
(AD-710234; CRREL-SR-140) Avail: NTIS CSCL 8/13

A mathematical model was developed to describe one-dimensional wave propagation in a resonating column of a material with a nonlinear constitutive relation. The nonlinear partial differential equation which resulted was solved using a finite differencing method, and a computer program was written to simulate a resonating column. The computer simulation program was used to find a dynamic nonlinear constitutive relation for a sand and a clay by a trial-and-error method. It was discovered that the constitutive relation for these soils found by using a pseudo-nonlinear method (which is based on linear theory) agreed surprisingly well with the constitutive relation found using a genuine nonlinear theory. Convergence studies for the finite-differencing method were also made. Author (TAB)

N71-10074# North Carolina State Univ., Raleigh. Dept. of Mathematics.
THE STRESS INTENSITY FACTOR OF A GRIFFITH CRACK WHICH IS OPENED BY A THIN SYMMETRIC WEDGE
J. Tweed 15 Jun. 1970 18 p refs
(Grant AF-AFOSR-1770-69)
(AD-710315; AFOSR-70-2059TR) Avail: NTIS CSCL 20/11

The problem of determining the distribution of stress (within the terms of the classical theory of elasticity) in the vicinity of a Griffith crack which is opened by a thin symmetric wedge appears to have been considered first by Markuson. In this paper the author solves the problem by alternative approach which is based on a recent development in the theory of triple integral equations. Author (TAB)

N71-10117# Aeronautical Research Labs., Melbourne (Australia).
AXIAL LOAD FATIGUE TESTS ON CHROMIUM-MOLYBDENUM STEEL TUBING WITH WELDED FISH-MOUTH TYPE SPLICES
F. G. Harris and R. W. Rowan Mar. 1969 36 p refs
(ARL/SM-323) Avail: NTIS

Axial load fatigue tests with various combinations of mean stress and alternating stress, were carried out on specimens of

SAE 4130 Cr-Mo alloy steel tubing having welded fish mouth splices typical of aircraft design and manufacturing standards. It was concluded that: (1) the type of weld adopted causes a substantial reduction in the fatigue strength and at 1 million cycles under fully reversed axial loading conditions, a fatigue ratio of less than 0.1 can be expected. (2) the position of failure in the specimen is influenced by the maximum load of the fatigue cycle. At lower loads, a stress concentrator in the form of a cavity resulting from incomplete penetration of the weld metal causes failure in the larger tubes of the joint. From information available, this defect appears to be inherent in all splices of this particular type. Author

N71-10121*# Techtran Corp., Glen Burnie, Md.
STRESS DISTRIBUTION AROUND HOLES
G. N. Savin Washington NASA Nov. 1970 1005 p refs Transl. into ENGLISH of the book "Raspredeleniye Napryazheniy Okolo Otverstiy" Kiev, Naukova Dumka Press, 1968
(Contract NASw-1695)
(NASA-TT-F-607) Avail: NTIS HC$10.00/MF$0.65 CSCL 20K

Results of research on the concentration of stresses around holes and fissures are reported in a form convenient for application. The influence of rounding the corners of holes, distance between holes, rigidness of a fastening ring, and related problems are considered. Methods of solving these problems are given in the form of graphs, tables, and formulas. Each of the 12 chapters in the book treats a phase of the problem independently. A list of references is included at the end of each chapter. E.M.C.

N71-10166*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
NUMERICAL METHODS OF INTEGRATION APPLIED IN THE NONLINEAR DYNAMIC ANALYSIS OF SHELLS OF REVOLUTION
Joe R. Tillerson and James A. Stricklin 24 Jul. 1970 80 p refs Sponsored in part by Sandia Corp.
(Grant NGL-44-001-044)
(NASA-CR-108639) Avail: NTIS CSCL 13M

After evaluating numerous methods of numerically integrating the equations of motion formulated for nonlinear dynamic analyses of shells of revolution by the matrix displacement method, it is concluded that the Houbolt method is the most efficient and practical technique. A total of nine different integration techniques are formulated for use in nonlinear structural dynamic analyses by the finite element method. The results, conclusions, and observations of other investigators are discussed for each of the integration techniques. Each technique is initially evaluated in a nonlinear beam analysis (first vibratory mode only) to determine the most promising methods for use in shell analyses. Realistic test problems are used to evaluate three of the numerical integration procedures as applied in shell of revolution analyses. Author

N71-10190# Naval Research Lab., Washington, D.C.
FRACTURE PROPERTIES OF THE NEW DUAL STRENGTHENED 10% NICKEL STEEL IN TWO-INCH PLATE
Fred R. Stonesifer and Herschel L. Smith Jul. 1970 16 p refs
(AD-709904; NRL-MR-2144) Avail: NTIS CSCL 11/6

The new dual strengthened 10%Ni alloy appears particularly well suited for construction of large pressure vessels. An attractive combination of strength, toughness, and resistance to corrosion; as reported by other investigators, is derived through a heat treatment which combines the advantages of conventional low-carbon martensite with those of the maraging mechanism. A two-inch thick plate of this new alloy was welded by the standard TIG process and evaluated in relation to its fracture toughness properties. When properly austenitized and aged, this material shows excellent toughness at the 180,000 psi yield strength level. Overaging increases the toughness but depresses the yield strength. A critical crack depth of about one inch is calculated for the base plate under severe conditions. Present inspection techniques should have no problem detecting a crack of such magnitude. Author (TAB)

N71-10243# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
STRUCTURAL OPTIMIZATION OF A PANEL FLUTTER PROBLEM
Raymond H. Plaut [1970] 15 p refs Sponsored in part by ARO
(Contract N00014-67-A-0191-0008)
(AD-709955) Avail: NTIS CSCL 20/11

Recent reviews have described the present status of research on panel flutter. A new development concerns the structural optimization of panels in order to minimize the panel weight while satisfying certain flutter requirements. An approximate method for obtaining the optimal panel design is proposed in this paper and calculations are carried out for a panel with segmentwise constant mass distribution. The results, while only approximate, indicate that significant savings in weight may be possible with the use of nonuniform panels. Author (TAB)

N71-10262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLIED MECHANICS: ENGINEERING MECHANICS DIVISION
In its Space Programs Summary 37-64, Vol. 3, 31 Aug. 1970 p 88-112 refs (See N71-10251 01-34)
Copyright. Avail: NTIS CSCL 20K

Research progress is reported on nuclear radiation mapping of thermoelectric outer planet spacecraft, the maximum dynamic response of structures, nonlinear vibration of an infinite long circular cylinder, holography application study to pressure vessel flaw detection, holographic interferometry application to shell structures, fiber-reinforced composite materials for spacecraft antenna structures, and results of Apollo gamma ray spectrometer thermal model tests. R.B.

N71-10273# Royal Aircraft Establishment, Farnborough (England).
CUMULATIVE FREQUENCY DISTRIBUTIONS OF AIRCRAFT LANDING GEAR LOADS [ZUR AUFSTELLUNG VON LASTKOLLEKTIVEN FUER FLUGZEUGFAHRWERKE]
O. Buxbaum et al Jun. 1970 27 p refs Transl. into ENGLISH from Luftfahrttech.-Raumfahrttech. (West Germany), v. 15, no. 11, 1969 p 269-274
(RAE-LIB-Trans-1462) Avail: NTIS CSCL 20K

The increased damage to modern aircraft landing gears caused by frequently repeated loading necessitates detailed analyses of the fatigue strength of landing gears similar to those carried out on aircraft wings. A provisional working foundation is presented for the collection of all available load spectra whether based on theoretical or experimental information. The proposals offered combine the present state of knowledge with some recent measurements and extend the ground covered by current theories. Load cases which are critical from the fatigue viewpoint are summarized and emphasis is placed on defining those data which determine the cumulative frequency distributions of undercarriage loads. D.L.G.

N71-10438*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRESS CONCENTRATIONS IN FILAMENT-STIFFENED SHEETS OF FINITE LENGTH
W. B. Fichter Washington Nov. 1970 16 p refs
(NASA-TN-D-5947; L-7321) Avail: NTIS CSCL 13M

A simple model of filamentary composite material is employed to investigate stress concentrations in a filament-stiffened sheet of finite length. The model is composed of a single layer of parallel, tension-carrying filaments embedded in a shear-carrying matrix. The sheet is of finite length in the filament direction and of infinite length normal to the filament direction. Filament stress-concentration factors are calculated as functions of the number of broken filaments and a length-stiffness parameter for the cases of uniform normal edge load and uniform normal edge displacement. In the

uniform-edge-load case, the stress-concentration factors are found to increase with decreasing filament length. The opposite effect is noted in the uniform-edge-displacement case where, in addition, the stress-concentration factor is found to have an upper limit which is fixed by the value of the length-stiffness parameter. Author

N71-10442# Technical Univ., Copenhagen (Denmark). Structural Research Lab.
TWO NEARLY POLYGONAL HOLES. MATHEMATICAL CRACK PROBLEMS
Esben Byskov 1969 8 p refs
(AD-709848; Rept-10) Avail: NTIS CSCL 20/11

The paper gives approximate solutions to two practical crack problems, namely a square and a hexagonal hole with small symmetrical corner cracks. The boundaries of the holes including the cracks are idealized by hypocycloids with 4 and 6 cusps, respectively Author (TAB)

N71-10448*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AXISYMMETRIC STRESSES AND DISPLACEMENTS IN TWO FINITE CIRCULAR CYLINDERS IN CONTACT
Clarence J. Wesselski (M. S. Thesis—Houston Univ.) Nov. 1970 49 p refs
(NASA-TM-X-58052) Avail: NTIS CSCL 13M

A boundary value problem of two elastic bodies in contact is considered. The bodies are finite circular cylinders of different dimensions and material constants and are isotropic and homogeneous. They are forced into contact across the plane faces such that the resulting stresses and displacements are axisymmetric. The solution utilizes Love's stress function to generate a family of biorthogonal eigenfunctions for each cylinder. The interrelated Fourier coefficients are expressed implicitly by an infinite system of linear algebraic equations. By truncation, an explicit solution of the Fourier coefficients is obtained. Two example problems are solved: in frictionless contact and in bonded contact. In each problem, the other face of each cylinder undergoes a constant displacement with zero shear tractions. Selected numerical results are presented in graphical form. Author

N71-10484# General Motors Research Labs., Warren, Mich. Materials and Structures Lab.
A SELECTED BIBLIOGRAPHY ON DYNAMIC PROPERTIES OF MATERIALS Final Report
Douglas R. Christman Jun. 1970 117 p refs
(Contract DASA01-68-C-0114)
(AD-710823; MSL-70-06; DASA-2511) Avail: NTIS CSCL 20/11

The bibliography is a compilation of recent (primarily 1966-1969) publications on dynamic properties of materials. There are three sections: (1) Materials (6061-T6 aluminum, titanium, copper, tantalum and polymethylmethacrylate) (2) material characterization (shock waves, equation of state, deformation, dislocations, fracture, spall, ultrasonics and elastic constants); and (3) experimental techniques. Over 300 different entries are given with abstracts included for over 75%. Author (TAB)

N71-10485# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs.
STRUCTURAL ANALYSIS, FRAILTY EVALUATION AND REDESIGN. VOLUME 1: SAFER THEORETICAL BASIS Technical Report, 15 May 1968—30 Jan. 1970
R. J. Melosh Jul. 1970 98 p refs
(Contract F33615-68-C-1530)
(AD-710889; AFFDL-TR-70-15-Vol-1) Avail: NTIS CSCL 13/13

The report defines the equations upon which the SAFEF computer program is based. Mathematical models of a line and a flat triangular surface element are given. These models are suitable for predicting responses of structures with linear behavior. Stiffness models are given for evaluating deflections; cross section models for stress. Transformations provide for simulating element connections at other than their neutral surfaces. A modified Gauss decomposition process is selected for solving the load-deflection equations of structures. Checks are given to identify kinematic instability, numerical singularity, and inaccuracy in stress predictions; all in association with the solution process. A general, direct, and exact procedure is delineated for determining the response of the structure if an element is removed or changed in size. The removal process is prescribed for predicting the fail-safety factor of a structure. It includes a check to evaluate kinematic stability when each element is removed. Author (TAB)

N71-10492# Catholic Univ. of America Washington, D.C. Inst. of Ocean Science and Engineering.
A SURVEY OF PUBLICATIONS ON MECHANICAL WIRE ROPE AND WIRE ROPE SYSTEMS
Hendrikus H. Vanderveldt and Ron DeYoung Aug. 1970 128 p refs Revised
(Contracts N00014-68-A-0506-0001; N00024-70-C-5439; Proj. Themis)
(AD-710806; Rept-70-8-Rev) Avail: NTIS CSCL 13/9

The purpose of the report is to determine the extent of literature available in regard to the mechanical response of stranded cables. The survey has been organized into three categories, i.e., single wires, single strands and the composite wire rope. The various parameters, such as the mechanical response, the fatigue behavior, corrosion, corrosion protection, shock and impact and others have been considered under each of these major categories. Author (TAB)

N71-10688# Brown Univ., Providence, R.I.
BOUNDS OF MOTIONS OF SOME LUMPED AND CONTINUOUS DYNAMIC SYSTEMS
R. H. Plaut and E. F. Infante [1970] 30 p refs
(Contract N00014-67-A-0191-0008)
(AD-710787) Avail: NTIS CSCL 13/13

Lumped and continuous systems subjected to general dynamic loads or perturbations are considered. The motions of these systems are assumed to be described by ordinary or partial differential equations with time-varying forcing terms. Upper bounds on the motions are derived with a Liapunov type of approach. The results are applied to some structural dynamics problems: displacement bounds are determined for elastic columns, plates, and arches, and sufficient conditions for stability of arches against snap-through are obtained. Author (TAB)

N71-10691# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATIONS OF ELASTICITY AND PLASTICITY Collection of Articles
V. V. Ponyatovskii et al 20 Apr. 1970 277 p refs Transl. into ENGLISH from Issled. Uprugosti Plast (Leningrad), no. 4, 1965 p 1—64 and 72—219
(AD-711129; FTD-HC-23-361-69) Avail: NTIS CSCL 20/11

The articles cover questions of elasticity theory, plasticity theory, statics and dynamics of thin shells, and experimental methods for studying stresses and fracture conditions. Author (TAB)

N71-10692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF GUIDED BALLISTIC MISSILES
A. M. Sinyukov et al 8 May 1970 632 p refs Transl. into ENGLISH of the publ. 'Konstruktsiya Upravlyayemykh Ballisticheskikh Raket' Moscow, Izd. Min. Oborony SSSR, 1968 p 1—444
(AD-711130; FTD-MT-24-10-70) Avail: NTIS CSCL 10/4

General questions of the design of guided ballistic missiles with liquid- and solid-propellant rocket engines, the principles of the arrangement and the operation of contemporary rockets and their basic systems, and also questions of determining static and dynamic loads, affecting a rocket under diverse conditions of operation are examined. Also elucidated are questions of aerodynamic heating and variation in temperature fields in the elements of rocket design during the effect of different external factors on the rockets. In examining the designs of individual sections of rockets the methods of calculating their elements for strength and also the approximate calculation of a number of systems are presented. Author (TAB)

N71-10612# Sandia Corp., Albuquerque, N.Mex. Centrifuge, Vibration, and Acoustics Div.

EXPERIMENTAL MODAL STUDIES

D. O. Smallwood Jul. 1970 31 p refs Sponsored in part by AEC

(SC-DR-70-72) Avail: NTIS

Various techniques used to experimentally determine resonant frequencies, mode shapes, and damping coefficients of structures are discussed. The model which was used to illustrate the discussion, selection of the type of data presentation, the driving point, the driving mechanism, measurement of damping, and experimental problem areas are described. A co-quad phase separation technique is recommended for most testing of this type. Author

N71-10704# Watervliet Arsenal, N.Y.

FORCED TORSIONAL VIBRATIONS OF THIN SPHERICAL SHELLS

Gary Anderson Jun. 1970 36 p refs

(AD-711525; WVT-7033) Avail: NTIS CSCL 13/13

The method of determination of th integral transform which is appropriate to remove a certain combination of partial derivatives from a partial differential equation which is subject to a variety of boundary or boundedness conditions is developed and applied to the equation which describes the axisymmetric torsional oscillations of a thin spherical shell. The Gegenbauer, the odd Gegenbauer, and the even Gegenbauer transforms, which are appropriate to solve the forced motion problems for a complete spherical shell, a hemispherical shell with time-dependent loaded edge conditions, respectively, are derived, and the general forms of the solutions are given. Author (TAB)

N71-10713# Catholic Univ. of America, Washington, D.C.

LARGE DEFLECTIONS OF AXISYMMETRIC CIRCULAR MEMBRANES

Robert Kao and Nicholas Perrone Oct. 1970 22 p refs

(Grant NSF GK-23747)

Avail: NTIS

A nonlinear relaxation method is employed to solve the nonlinear partial differential equations governing the large deflection response of various axisymmetric circular membranes. The method proposed is an iterative approach used in conjunction with finite difference approximations and in its simplest form consists of only two operators. In principle, the method offers a technique of systematically reducing the errors at each nodal point for each algebraic equation to some acceptable level. In addition, the method is believed to be applicable in solving general types of nonlinear equations. The problems solved include uniformly loaded circular membrane, annular membrane with rigid central disc, and annular membrane with free inner edge. The numerical results obtained compare well with other results given in the literature. Author

N71-10719# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.

TRANSIENT RESPONSE OF A RING-REINFORCED CYLINDRICAL SHELL IMMERSED IN A FLUID MEDIUM, TO AN AXISYMMETRIC PULSE

J. Crouzet-Pascal and H. Gamet Oct. 1970 56 p ref

(RE-395) Avail: NTIS

The shell is infinitely long, the stiffening rings are periodically spaced and identical and the applied load is uniformly distributed. A technique is employed involving the superposition of steady state solutions, which were found in previous applications to be more suitable for problems involving complex interaction conditions than the customary transform approaches. The shell response is computed for an applied step pulse. The influence of the rings is determined from displacement and stress histories, and variations in their peak levels, plotted over a broad range of values of ring flexibility, mass, and spacing. The response to the dynamic load is also compared with the response obtained for a static load of equal amplitude. It is found, for example, that increasing only the ring mass can lead to a dynamic response that greatly exceeds the static response. When the ring mass has a negligible influence on the shell response, the trends followed by the peak dynamic displacement and stress with ring flexibility are not appreciably different from those followed by the corresponding static quantities. Author

N71-10829# Army Electronics Command, Fort Monmouth, N.J. Atmospheric Sciences Lab.

EVALUATION OF TOWER ANTENNA-PEDESTAL FOR MOBILE WEATHER RADAR AN/TPS-41

Casimir J. Matonis Jul. 1970 25 p

(AD-711520; ECOM-3317) Avail: NTIS CSCL 13/13

The report covers a discussion of the operational acceptance tests, their results, and the performance details of an advanced engineering model of a tower antenna-pedestal. The Tower Antenna-Pedestal (TAP), when used with the Mobile Weather Radar AN/TPS-41 constitutes a lightweight, portable, easily transportable, weather surveillance radar system. The tower-mounted antenna reduces ground clutter, thereby improving the overall weather surveillance capability and thus providing greater flexibility in the selection of operating sites. Author (TAB)

N71-10836# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.

REFLECTION OF OBLIQUE SHOCK WAVES IN ELASTIC SOLIDS

Thomas W. Wright Jun. 1970 63 p refs

(AD-710968; BRL-1483) Avail: NTIS CSCL 20/11

The reflection of a finite elastic plane shock wave at a plane boundary is examined. A semi-inverse method of solution is used. Only angles of incidence which are less than a critical angle are considered in detail. In general there are three reflected waves which may be either simple waves or shock waves. It is found that either kind of reflected wave may be completely specified by a single parameter provided conditions ahead of the wave are known. Boundary conditions at the plane surface must be solved for the specifying parameters. A simple existence theorem is stated, critical angle cases are discussed, and several simple examples are presented. Author (TAB)

N71-10837*# TRW Systems Group, Redondo Beach, Calif.

ANALYSIS OF FOLDING STRAINS ON COMPOSITE BLADDER STRUCTURES. VOLUME 2: PROGRAMMING MANUAL FOLDING STRAINS ANALYSIS PROGRAM

James R. Taylor 1 Apr. 1970 264 p refs Prepared for JPL

(Contract NAS7-882)

(NASA-CR-111133; TRW-AS189-Vol-2) Avail: NTIS CSCL 13M

The program performs a step-by-step large strain, elastoplastic static analysis of a two dimensional continuum. The program allows the user to perform a plane strain analysis using a rectangular coordinate system or to perform an axisymmetric strain analysis using a cylindrical coordinate system. The structure to be studied may consist of one or more homogeneous, isotropic materials whose plastic and elastic properties are temperature and strain rate

independent. The structure may be loaded either by specifying certain nodes to be subjected to imposed displacements or by specifying certain sides of some of the finite elements to be subjected to pressure loadings. Boundary conditions which constrain specified nodes from movement in one or both coordinate directions must be imposed by the user. One of the major features of the program provides for the analysis of folding bladder problems by the specification of a minimum amount of input. Author

N71-10838*# TRW Systems Group, Redondo Beach, Calif.
ANALYSIS OF FOLDING STRAINS ON COMPOSITE BLADDER STRUCTURES. VOLUME 1: TECHNICAL Final Report
L. D. Hofmeister 1 Apr. 1970 212 p refs Prepared for JPL
(Contract NAS7-682)
(NASA-CR-111306) Avail: NTIS CSCL 13M

A detailed study was conducted in order to develop rational methods to predict structural fatigue life of laminated expulsion bladders. The technical approach was to first compute plastic strains in typical single and double folds of bladder materials, and then relate these strains to experimental fatigue data in order to predict cyclic operating life of the bladder. A computer program, based upon the finite element method of continuum mechanics, was written for calculating the folding strains. The single fold was simulated by a plane strain model, whereas the double fold required an axisymmetric model. The program includes many features which should facilitate its use by a bladder design engineer, and output includes the prediction of fatigue life as well as a detailed printout of strains and stresses in the bladder model. The theory on which the computer program is based differs from others which also attack highly nonlinear static structural response in that the present theory allows a check on solution accuracy. This theory represents a significant contribution to the state-of-the-art in solid mechanics. Author

N71-10852# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATIONS OF FORCES APPEARING IN A FIBER OF INFINTE LENGTH WITH A TRANSVERSE IMPACT WITH VARIABLE VELOCITY
A. L. Pavlenko et al 6 Aug. 1970 24 p refs Transl. into ENGLISH from Sb. Reb. Vychisl. Tsent. Mosk. Gos. Univ. (Moscow), no. 4, 1965 p 287–302
(AD-711758; FTD-MT-24-103-70) Avail: NTIS CSCL 20/11

The paper investigates the solution of the wave problem concerning the stresses generated in an elastic stretchable filament of infinite length following a transverse impact of variable velocity. The strain-stress relationship is assumed nonlinear in general. The presentation of the basic equation and of the initial and boundary conditions is followed by a description of the wave patterns and an outline of the numerical calculation of the problem using the method of characteristics described by two of the present authors (A. L. Pavlenko, B. M. Pavlov, Sbornik rabot VTs MGU Chislennyye metody v gazovoy dinamike, no. 4, 1965, pp 261-286) Calculations are carried out for two different filaments, both obeying Hookes law. Author (TAB)

N71-10866*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A SUPERSONIC KERNEL-FUNCTION PROCEDURE TO FLUTTER ANALYSIS OF THIN LIFTING SURFACES
Herbert J. Cunningham Washington Nov. 1970 39 p refs
(NASA-TN-D-6012; L-6808) Avail: NTIS CSCL 20K

A description is presented of a systematic procedure for obtaining generalized aerodynamic forces from the lifting-surface theory by the supersonic kernel-function method and for using those forces thus obtained in a Galerkin modal flutter analysis. The method is applicable to planforms with subsonic leading and supersonic trailing edges. Analytical flutter results were obtained and compared with experimental values from three flutter models. Author

N71-10885# California Univ., Berkeley. Coll. of Engineering.
ANALYSIS OF CURVED FOLDED PLATE STRUCTURES
C. Meyer and A. C. Scordelis Jun. 1970 84 p refs Sponsored by Calif. State Div. of Highways and US Dept. of Transportation Bur. of Public Roads
(PB-193535; SESM-70-8) Avail: NTIS CSCL 13M

A computer program was developed which is capable of analyzing curved folded plate structures simply supported at the two ends and composed of elements that may in general be segments of conical frustra. The program is based on a harmonic analysis in the circumferential direction, with the loadings expressed by Fourier series, and on a finite element stiffness analysis in the transverse direction. The structure assembly and solution follows the direct stiffness method as it was successfully applied previously to straight prismatic folded plates. Author (USGRDR)

N71-10931# Illinois Univ., Urbana. Dept. of Civil Engineering.
A GENERAL FORMULATION FOR THE OPTIMUM DESIGN OF FRAMED STRUCTURES
William J. McCutcheon and Steven J. Fenves Aug. 1970 92 p refs *Its* Structural Res. Series No. 362
(Contract N00014-67-A-0305-0010)
(AD-711279) Avail: NTIS CSCL 13/13

A unified approach to the optimum design of framed structures based on a general matrix formulation is presented. Both elastic behavior, in the form of working stress limitations, and ultimate capacity are considered. The formulation is presented in the form of an iterative set of linear programming problems. The design variables relating to elastic and ultimate behavior are linearly related and the objective function is expressed as a linear function of the design variables. By making assumptions about the member properties and sizes, the constraints are also expressed in linear form. The formulation is initially developed for a structure acted upon by a single set of external loads, and is subsequently generalized to include multiple loads and alternative loading combinations. Yield and working stress limits, which are defined to include the effect of stress interaction, are specified only at member ends. Therefore, loads are restricted to concentrated forces and couples at the joints. A computer program was written to implement the formulation and was used to solve several sample problems. Author (TAB)

N71-10944# California Univ., Berkeley. Structural Engineering Lab.
FINITE ANALYSIS OF TUBULAR K JOINTS
Ojars Gresle Jun. 1970 169 p refs Sponsored by Standard Oil Co. of Calif.
(PB-193560; SESM-70-11) Avail: NTIS CSCL 13M

The study is concerned with the finite element analysis of a class of tubular K joints and with the automatic generation of data for the analysis. The type of joint considered consists of two smaller diameter tubes welded to a larger diameter tube in the form of a K. The structure is discretized by triangular and quadrilateral shell elements having five degrees of displacement freedom per node. Substructuring is used in the analysis in order to minimize the computational effort. The finite element model for the K joint is generated automatically by the analysis computer program from a description of the joint geometry and degree of mesh refinement desired. Some comparisons of analysis results with experimental data are presented. Author (USGRDR)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-10038# Leeds Univ. (England). Information Centre on High Temperature Processes.
HIGH TEMPERATURE THESAURUS
Frances M. Armes, comp. Oct. 1969 116 p
Avail: NTIS

The thesaurus contains 500 index terms in three areas: chemical facet, document facet, and physical facet. The terms are organized into a weak hierarchical system with the designations of higher term and lower term. N.E.N.

N71-10050# Naval Postgraduate School, Monterey, Calif.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF ROTATING, NON-CAPILLARY HEAT PIPES Annual Report, Sep. 1969–Jun. 1970
Paul J. Marto, Leonard J. Ballback, and Thomas J. Daley 30 Jun. 1970 44 p refs
(AD-709907; NPS-59MX70061A) Avail: NTIS CSCL 13/1

An analytical review of the operation of rotating, non-capillary heat pipes is presented, including a discussion of film condensation on the inside of a rotating, truncated cone. Predicted results so far obtained indicate that the heat transfer capability of rotating, non-capillary heat pipes depends upon condenser performance and is substantially higher than the capability of conventional, wick-limited heat pipes. The design and manufacture of an experimental rotating heat pipe apparatus is also described. Author (TAB)

N71-10064*# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
FILM BOILING ON VERTICAL SURFACES IN TURBULENT REGIME
Narasipur V. Suryanarayana (Ph.D. Thesis) and Herman Merte, Jr. Sep. 1970 206 p refs
(Contract NAS8-20228; ORA Proj. 07461)
(NASA-CR-110997) Avail: NTIS CSCL 20M

The variables studied in the determination of the local heat flux values were the height of the heating surface and heater surface superheat in two cryogenic liquids, nitrogen, and hydrogen. To avoid edge effects in a finite plane vertical surface, cylindrical heating surfaces were used. Heat flux values at 11 locations over a total height of 6 in. at four values of surface superheat were determined, employing a transient technique. A warm cylindrical heating surface with thermally insulated instrumented sections was immersed in the cryogenic fluid, inducing film boiling, and the rate of cooling was recorded. From this rate of cooling and properties of the test sections, heat transfer rates were computed. The region of laminar vapor film was extended by reducing gravity forces in a drop tower. Local heat flux values at six locations in a height of 4 in. were determined for one value of surface superheat each in liquid nitrogen and liquid hydrogen at a/g approximately 0.008. Additional heat flux values were obtained under subcooled conditions. Author

N71-10169# Utah Univ., Salt Lake City. Coll. of Engineering.
A TURBULENT BOUNDARY LAYER WITH MASS ADDITION, COMBUSTION, AND PRESSURE GRADIENTS
Jerold W. Jones and L. K. Isaacson May 1970 147 p refs
(Contract F44620-68-C-0022; Proj. Themis)
(AD-710308; THEMIS-UTEC-TH-70-064; AFOSR-70-1428TR) Avail: NTIS CSCL 21/2

A subsonic turbulent boundary layer with mass addition and combustion is studied to investigate the effects of combustion on the velocity field in constant pressure and accelerating flows. Particular attention is given to determining (1) the extent to which combustion alters the flow and (2) the mechanism whereby combustion interacts with the flow field. The experimental results demonstrate that combustion alters the velocity profiles in both constant pressure and accelerating flows. The velocity gradients at the surface in combusting flows differ markedly from those of corresponding isothermal flows and the velocity in the flame regions of accelerating flows actually exceed the freestream value. The results of analysis indicate that in a subsonic turbulent boundary layer with combustion the Reynolds stress is essentially kinematic and does not explicitly involve density fluctuations. This in turn indicates that the experimentally observed changes in the velocity profiles are attributable to the temperature dependence of the local mean density and molecular viscosity. Analytical results also indicate that the combustion-induced changes in velocity profile are strongly dependent on the axial pressure gradient. The consequence of combustion with regard to skin friction is also examined and it is found that effects on the skin friction coefficient are similar to those on the wall velocity gradient. A method of determining the velocity profiles in a combusting turbulent boundary layer is also presented. Author (TAB)

N71-10187# Sheffield Univ. (England). Dept. of Fuel Technology and Chemical Engineering.
COMBUSTION FUNDAMENTALS
J. Swithenbank Feb. 1970 161 p refs
(Grant EOOAR-69-0050)
(AD-710321; HIC-150; FTCE5/JS/2/70; AFOSR-70-2110TR) Avail: NTIS CSCL 21/2

Fundamental aspects of combustion are reviewed with particular emphasis on turbulence and stirred reactor concepts. The results are applied to several systems of practical importance: The optimization of burner design minimizing pressure loss; The design and constraints of supersonic combustors; The generation of aperiodic combustion oscillations (i.e., combustion roar). Author (TAB)

N71-10238*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNIQUE FOR THE DIRECT MEASUREMENT OF THERMAL CONDUCTIVITY AT HIGH TEMPERATURES BY THE USE OF A HEAT PIPE
Ralph Forman Oct. 1970 17 p refs
(NASA-TM-X-52909) Avail: NTIS CSCL 20M

An experimental technique for accurately measuring thermal conductivity in the temperature range of 800 to 1500 C is presented. The procedure is capable of making a direct measurement of the heat flux and temperature drop across a sample by the use of a heat pipe to transport the heat flux. The technique eliminates many of the uncertainties associated with methods presently employed to measure thermal conductivity at these high temperatures. Other applications of the method are also discussed. Author

N71-10289# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL PROPERTIES OF MATERIALS Summary Technical Report, 1 Jan.–31 Dec. 1969
C. Y. Ho Wright-Patterson AFB, Ohio AFML Jun. 1970 123 p refs
(Contract F33615-68-C-1229)
(AD-709956; AFML-TR-70-92) Avail: NTIS CSCL 5/2

The technical report covers work in a continuing systematic program on the thermophysical properties of materials involving the literature search, acquisition, codification, and organization, and

data extraction, compilation, evaluation, correlation, analysis, and synthesis, the preparation of intermediate tables presenting the total available experimental information, and the final preparation of internally consistent tables of best data. The work reported on consists of both data tables projects and scientific documentation efforts. The data tables projects are on the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermettalic, semiconducting, and nonmetallic compounds, cermets, ceramics, mixtures, composites, systems, polymers, etc., and on the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Property data are presented in both tabular and graphical forms, with accompanying tables giving specifications and characterizations of the test specimens for the data. This report does not contain the completed thousands of data sheets, but does reproduce in the Appendix, the Table of Contents and the Grouping of Materials and List of Figures and Tables for each of the first 7 volumes (which contain over 8000 pages) of the TPRC DATA SERIES to show the scope of their coverage. Author (TAB)

N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 – 8 Dec. 1969
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969 245 p refs
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M

An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

N71-10437# Rocketdyne, Canoga Park, Calif.
COMPREHENSIVE ANALYSIS OF LIQUID ROCKET COMBUSTION
R. D. Sutton, W. S. Hines, and L. P. Combs Jun. 1970 16 p refs Presented at the AIAA Propulsion Joint Specialist Conf. (6th), San Diego, 15 – 19 Jun. 1970
(Contracts F04611-68-C-0043; AF 49(638)-1705)
(AD-710634; AFOSR-70-2045TR) Avail: NTIS CSCL 21/8

A comprehensive method for analyzing liquid rocket engine combustion is introduced, which utilizes and unifies the results of analytical and experimental research in the fields of liquid propellant injection and combustion. A system of 3-dimensional, time-dependent, nonlinear conservation equations is derived and the necessary expressions for bipropellant spray mass distributions, drop size, drop velocities, spray evaporation, and interphase drag are presented. Specialized application of the general model to the analysis of ablative chamber compatibility is summarized and illustrated. Another application, research for improvement of relations for the interphase coupling processes, is outlined. Author (TAB)

N71-10481# Oak Ridge National Lab., Tenn.
HIGH TEMPERATURE ENTHALPIES OF THE LEAD HALIDES: ENTHALPIES AND ENTROPIES OF FUSION
Clarence W. Linsey (Ph.D. Thesis–North Texas State Univ.) Jun. 1970 103 p refs Sponsored by AEC
(TID-25453) Avail: NTIS

Since lead halides can be prepared in high purity and are thus amenable to high-precision thermal measurements, the objectives of this investigation were: (1) to establish calorimetrically the transition temperature for the orthorhombic to cubic transition exhibited by PbF2 and to determine the enthalpy of this transition; (2) to determine if the solid-solid phase transitions claimed in the literature for PbCl2, PbF2, PbBr2 and PbI2 were of thermodynamic importance, and if so, to determine the enthalpies of transition; (3) to determine if the discontinuous thermal expansions reported for lead halides were of thermodynamic importance; and (4) to obtain reliable heat content data for the lead halides in both the solid and liquid states. Author

N71-10548# Purdue Univ., Lafayette, Ind. Atlantic Research Corp., Alexandria, Va. Project Squid Headquarters
COMBUSTION OF BORON PARTICLES AT ELEVATED PRESSURES
Andrej Macek (Atlantic Res Corp.) and J. McKenzie Semple (Atlantic Res. Corp.) Jun. 1970 34 p refs Presented at the 13th Intern. Combust. Symp., Salt Lake City, Aug. 1970 Prepared in cooperation with Atlantic Res. Corp.
(Contract N00014-67-0226-0005; Proj. Squid)
(AD-710747; SQUID-TR-ARC-13-PU) Avail: NTIS CSCL 21/2

Combustion of single boron particles, about 75 microns in diameter, from a crystalline powder sample has been studied. Particles were ignited by being dropped through a focused laser beam in several oxidizing gases over a range of pressures. In pure oxygen, in air, and in O2/Ar(20/80), particles were merely preheated to a temperature about 2000K; ignition took place spontaneously after a measurable induction period. Quantitative values of both the induction period and the subsequent self-sustained combustion period are listed. It was shown that the classical theory of ignition and combustion can account for all three observed burning modes: metastable surface reaction during the preignition period, rapid self-sustained diffusion-combustion, and decaying combustion. Previously reported reaction-rate and ignition-limit data were used for quantitative estimates of parameters pertaining to the three regimes. Author (TAB)

N71-10568# Naval Ordnance Lab., White Oak, Md.
TRANSPIRATION COOLING EXPERIMENTS NEAR THE STAGNATION LINE OF A CYLINDER IN CROSS FLOW Final Report
Richard L. Humphrey 10 Mar. 1970 34 p refs
(AD-710739; NOLTR-70-48) Avail: NTIS CSCL 20/13

Tests were made with a cylindrical model transpiration cooled over a region plus or minus 15 deg. from the stagnation line. Air was used as the coolant. The model was tested at a nominal Mach number of 7.0. Wall temperatures and heat-transfer rates were in good agreement with predicted values. The effect of the external pressure distribution on the local coolant flow rate and wall temperature is discussed. Author (TAB)

N71-10606*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
DESIGN OF A DUAL PATCH MULTIELEMENT RADIANT COOLER, PHASE 1 Final Report, 16 Feb. – 16 Jul. 1970
R. V. Annable and J. F. Lodder Jul. 1970 74 p refs
(Contract NAS5-21132)
(NASA-CR-111134) Avail: NTIS CSCL 13A

The thermal and mechanical design of a dual patch multi-element radiant cooler for earth oriented applications is described. The cooler is designed to attain temperatures of 120K and 90K in a circular 9:30 AM orbit at an altitude of 450 n mi. The patches are designed to accommodate a 14 element InAs array at 120K and a 4 element HgCdTe array at 90K. A thermal analysis for the specified orbit and a plan for testing the cooler are included. The designs studied show a direct trade-off between low patch temperatures and small cooler dimensions. Variations in thermal properties show that temperatures are most sensitive to changes in the emissivity of the low-emissivity surfaces within the cooler. Author

N71-10693# California Univ., Berkeley. Div. of Aeronautical Sciences.
KINETIC THEORY ANALYSIS OF TEMPERATURE JUMP IN A POLYATOMIC GAS

Jaw Tian Lin (Ph.D. Thesis) Jun. 1970 84 p refs
(Contract N00014-69-A-0200-1021)
(AD-711097; AS-70-6) Avail: NTIS CSCL 20/13

A kinetic theory analysis of the temperature jump at the wall and the temperature distribution near the wall in polyatomic gases has been made. The collision term in the Boltzmann equation is represented by a classical (BGK-type) polyatomic model. The problem was linearized by considering small temperature and density variations over their respective mean values, which leads to three simultaneous singular linear integral equations. For the solution of the problem, a direct numerical method was used. The integral equations were reduced to a set of simultaneous linear equations for discrete values of the dependent variables by approximating the integrals with suitable quadrature formulas. The solution of this problem shows that, contrary to some suggestions in the literature, the expression for the temperature jump of a monatomic gas cannot be simply extended to apply also to polyatomic gases. Author (TAB)

N71-10702# Naval Postgraduate School, Monterey, Calif.
THE EXPERIMENTAL DESIGN AND OPERATION OF A ROTATING WICKLESS HEAT PIPE
Thomas James Daley (M.S. Thesis) Jun. 1970 61 p refs
(AD-709923) Avail: NTIS CSCL 13/1

An experimental rotating wickless heat pipe apparatus was designed and machined. The apparatus includes a rotating heat pipe assembly, test stand, spray cooling assembly, safety shielding, and instrumentation. A revised condensing limit for the operation of the rotating heat pipe was obtained by modifying Ballbacks Nusselt film condensation theory to include the effects of a thermal resistance in the condenser wall and in the condenser outside surface cooling mechanism. Approximate results, obtained for half-cone angles of 1, 2, and 3 degrees, show that less heat can be removed than originally predicted by Ballback, and that the outside heat transfer coefficient can significantly alter the condensing limit. An improved Nusselt theory was developed which applies for all half-cone angles, and which includes the effects of the thermal resistances in the condenser wall and in the condenser outside surface cooling mechanism. This formulation led to a second-order non-linear differential equation for the film thickness which was numerically integrated using a free-overfall boundary condition at the condenser exit. Results obtained for a half-cone angle of 0 degrees are substantially less than the results obtained from the approximate solution for half-cone angles of 1, 2, and 3 degrees. Author (TAB)

N71-10867*# General Electric Co., Schenectady, N.Y. Research and Development Center.
HEAT TRANSFER ON A FLAT PLATE IN CONTINUUM TO RAREFIED HYPERSONIC FLOWS AT MACH NUMBERS OF 19.2 AND 25.4
H. T. Nagamatsu, W. T. Pettit, and R. E. Sheer, Jr. Washington NASA Nov. 1970 53 p refs
(Contract NASw-1785)
(NASA-CR-1692) Avail: NTIS CSCL 13M

Surface heat transfer rates were measured on a sharp flat plate at zero angle of attack in a hypersonic shock tunnel at flow Mach numbers of 19.2 and 25.4. The density and Knudsen number were altered to span the continuum to near free molecule flow regimes. For both Mach numbers, the heat transfer data agree reasonably well with the strong interaction predictions of Li and Nagamatsu for Reynolds number per inch greater than 10,000 and leading edge Knudsen numbers less than 4. Below a unit Reynolds number of 10,000 a systematic reduction in the heat transfer rate close to the leading edge was observed for both Mach numbers. Furthermore, the Stanton number remained relatively constant independent of Mach number and unit Reynolds number. Author

N71-10892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIBLIOGRAPHY OF HEAT AND MASS TRANSFER 1964–1966), VOLUME 2
30 Apr. 1970 365 p refs Transl. into ENGLISH from the Russian
(AD-711147; FTD-HC-23-240-69) Avail: NTIS CSCL 20/13

The bibliography is volume 2 of a compilation of articles on heat and mass transfer published in the Russian literature from 1964 to 1966. TAB

N71-10921# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
CALCULATION OF THE VAPOR PRESSURE AND HEATS OF VAPORIZATION AND SUBLIMATION OF LIQUIDS AND SOLIDS BELOW ONE ATMOSPHERE PRESSURE. 9: NEON
W. T. Ziegler, G. N. Brown, and J. D. Garber 1 May 1970 64 p refs
Contract NBS CST-7973)
(TR-1) Avail: Issuing Activity

The best available experimental thermal data, together with suitable thermodynamic relations, were used to compute the vapor pressure and heats of vaporization and sublimation of naturally occurring neon. Calculations are presented in tabular form from 30 to 27.102 K (the normal boiling point) in 0.5 deg intervals, from 27.102 to 24.552 K (the triple point) in 0.1 deg intervals and from the triple point to 2.5 K in 0.2 deg intervals. These tabular values were also fitted by means of empirical equations. Comparison of the computed vapor pressure values with experimental data indicates that the computed values represent the experimental data to within 0.01 K over the experimental range 20-30 K. It is believed that the computed values provide the best estimate of the vapor pressure of solid neon presently available for temperatures below 20 K. The calorimetric entropy of neon as an ideal gas at 27.102 K and one atm pressure was determined to be 23.138 + or − 0.16 e.u. which may be compared with the statistical value of 23.034 e.u. The heat of sublimation of 0 K was computed to be 449.1 cal/mole. Author

N71-10985*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF HEAT PIPES FOR ELECTRICAL ISOLATION
Roland Breitwieser 29 Oct. 1970 8 p refs Presented at the Thermionic Conversion Specialist Conf., Miami, Fla., 26–29 Oct. 1970; sponsored by Inst. of Elec. and Electron. Engr.
(NASA-TM-X-52928; E-6059) Avail: NTIS CSCL 13A

Some of the problems of electrical isolation of the emitter from the heat source in out-of-core thermionics can be circumvented by the use of long heat pipes as electrical resistive elements. The various relations governing electrical resistance, heat pipe geometry, heat pipe pumping limits, and temperature losses were used to estimate the performance of heat pipes used in this manner. The design variables are the form of the electrical network, heat pipe length, heat pipe diameter, wall thickness, the wick design in the adiabatic section of the pipe, and heat pipe materials. First order calculations project the attainment of 28 volts with small penalties in system performance. Author

N71-10994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REEXAMINATION OF HEAT PIPE STARTUP
Peter M. Sockol and Ralph Forman [1970] 4 p refs Presented at the 1970 Thermionic Conversion Specialist Conf., Miami, Fla., 26–29 Oct. 1970; sponsored by IEEE
(NASA-TM-X-52924) Avail: NTIS CSCL 13A

Visual observation in a lithium heat pipe of the high temperature profiles during startup were made. Cotter's model of the startup process is reassessed in the light of these observations. The model is modified by moving the sonic point to the end of the hot zone and including the opposing effects of wall friction and condensation on the flow. Transient measurements have been made on a lithium heat pipe for startup to temperatures in the range

1000 to 1400 C. As predicted by the theory, the temperature of the hot zone is fairly independent of the power input to the evaporator until the hot zone reaches the end of the pipe. The hot zone temperature predicted by the theory is 50 to 80 C higher than the measured value with up to 30 C of the discrepancy attributable to the measurement. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N71-10013# General Accounting Office, Washington, D.C.
DIFFERENCES IN ALLOWING CORPORATE EXPENSES AS CHARGES TO GOVERNMENT CONTRACTS AT GOVERNMENT-OWNED, CONTRACTOR-OPERATED PLANTS BY THE DEPARTMENT OF DEFENSE, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, ATOMIC ENERGY COMMISSION (B-124125) Comptroller General's Report to the Congress
Elmer B. Staats 14 Nov. 1968 33 p refs
Avail: Issuing Activity

The policies and practices followed by the three agencies in allowing corporate general and administrative (G and A) expenses are reviewed and the differences are discussed. The emphasis is on DOD and AEC; no NASA-owned contractor-operated plants were included. It was found that DOD and NASA generally will pay G and A expenses incurred (1) in the performance of the contract or (2) in the normal conduct of a contractor's business as a whole, but AEC generally will pay only the former. Differences in practices are attributed to differences in cost principles between DOD and AEC in the treatment of corporate expenses, differences in the administration of existing principles, and circumstances requiring special contractual arrangements. N.E.N.

N71-10030# Programmes Analysis Unit, Didcot (England).
TECHNOLOGICAL FORECASTING AS A MANAGEMENT TOOL
P. M. S. Jones Oct. 1969 32 p refs Presented at Lecture to Polytechnic School of Management Studies Course, 19-23 May 1969
(PAU-M-10) Copyright. Avail: NTIS; HMSO 5s; BIS $1.00

Technological forecasting, which is defined as the prediction of the levels of technology which will be achieved or needed in a future social/economic environment, is discussed as a management tool. The objectives of technological forecasts from the industrial and national standpoint are to identify: (1) demand patterns and technical improvements in existing products, (2) new or greatly improved products, (3) future developments in technological fields which affect the viability of existing or future business, (4) military or economic threats to the nation, and (5) changes in society that result from innovations. Forecasting for research and development management, and the techniques of forecasting are also discussed. F.O.S.

N71-10116# Department of Transportation, Washington, D.C.
TRAVELER SERVICE STUDY
Jul. 1970 334 p Prepared by Golightly and Co. Intern., Inc.
(PB-193300) Avail: NTIS CSCL 05B

The principal traveler service problems in domestic intercity air, bus and rail transportation were studied. The specific experiences and problems of the young, the elderly, the poor, the ill, and the handicapped traveler received particular attention. Over 200 passengers were interviewed during June and July, 1970 in terminals located at New York, Chicago and Houston. Interviews were conducted at Pennsylvania Station, Port of New York Authority Bus Terminal, East Side Airlines Terminal and LaGuardia Airport in New York; O'Hare International Airport in Chicago; and the international airport and private bus terminals in Houston. Travelers aid, law enforcement officials, and carrier personnel at these terminals were also interviewed. The approximate distribution by mode of the passenger interviews was: air - 57 percent; bus - 28 percent; and rail - 15 percent. Copies of the questionnaires used for passenger interviews are appended. Author

N71-10126# Royal Radar Establishment, Malvern (England).
RRE NEWSLETTER AND RESEARCH REVIEW, NO. 8
1969 151 p refs
Copyright. Avail: NTIS

Newsletters are presented on research in electronics, solid state devices, microwave equipment, electro-optics, magnetic fields, semiconductors, integrated circuits, and their applications. For individual titles see N71-10126 through N71-10185.

N71-10201# Royal Radar Establishment, Malvern (England).
RRE NEWSLETTER AND RESEARCH REVIEW, NO. 9
1970 125 p refs
Copyright. Avail: NTIS

Newsletters are presented on research in electro-optics, solid state devices, electronics, electroluminescence, semiconductors, microwave equipment, infrared instruments, tracking radar, integrated circuits, and meteorological and astronomical instruments. For individual titles see N71-10202 through N71-10234.

N71-10235# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, JULY 1970
Jul. 1970 36 p refs
(NAVSO-P-3012) Avail: NTIS

Technical progress on individual projects of the research and development program are briefly summarized. A background statement of the problem considered in each of the projects is given along with a description and status report of the research involved. In addition, an in-depth presentation is given on a completed project involving the process of introducing known quantities of water vapor with good precision into evacuated systems. D.L.G.

N71-10236# Federal Aviation Administration, Washington, D.C. Task Force on Deterrence of Air Piracy.
US EFFORTS TO DETER HIJACKING. A PRESENTATION TO FOREIGN COUNTRIES AND AIRLINES
10 Jun. 1970 60 p
Avail: NTIS

A study undertaken by the Task Force on Deterrence of Air Piracy is outlined, and the methods and techniques used by the task force in developing the two-phase anti-hijacking system are described. The screening system elements consist of the known behavioral characteristics of hijackers and a detection device that detects masses of ferrous metal. The field testing, evaluation processes, and operational phase of the system are described and the material highlights the use of an interdisciplinary task force technique in problem solving. Author

N71-10247# Colorado State Univ., Fort Collins.
TRANSPORTATION RESEARCH NEEDS RELATED TO CIVIL ENGINEERING
Robert F. Baker Jun. 1970 288 p refs Prepared in cooperation with Am. Soc. of Civil Engr.
(PB-193388; CER69-70C WT41) Avail: NTIS CSCL 15E

The civil engineering research needs in the field of transportation are reported. A program is drawn looking to the future needs of the profession for the type of engineering information, data, and

findings best developed through purposeful research. The present and immediate future needs for research in the civil engineering aspects of transportation are discussed. Needed research in associated fields is indicated but not detailed. Transportation is considered as a system made up of a grouping of parts, or sub-systems, of social and economic programs. The role of transportation in society, and the interest that the civil engineer has in transportation are established. A program of research is presented in considerable detail with estimates of the level of funding considered to be necessary if the profession is to improve and enlarge its capabilities to meet the future needs for transportation of the society. Many subjects, such as, soil mechanics and foundations, structures, and environmental considerations, which are vital to overall development of a transportation system were treated lightly. Author

N71-10251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY 37-64. VOLUME 3: SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT, 1 JUNE - 31 JULY 1970
31 Aug. 1970 183 p refs
(Contract NAS7-100)
(NASA-CR-111002) Copyright. Avail: NTIS CSCL 05B

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5. COMMUNICATIONS ELEMENTS RESEARCH: TELECOMMUNICATIONS DIVISION p 44-47 refs (See N71-10256 01-07)

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8. GUIDANCE AND CONTROL ANALYSIS AND INTEGRATION: GUIDANCE AND CONTROL DIVISION p 72-73 refs (See N71-10259 01-21)

9. SPACECRAFT CONTROL: GUIDANCE AND CONTROL DIVISION p 74-78 (See N71-10260 01-21)

10. MATERIALS: ENGINEERING MECHANICS DIVISION p 79-87 (See N71-10261 01-03)

11. APPLIED MECHANICS: ENGINEERING MECHANICS DIVISION p 88-112 refs (See N71-10262 01-32)

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16. LIQUID PROPULSION: PROPULSION DIVISION p 153-161 refs (See N71-10267 01-28)

17. TRACKING AND ORBIT DETERMINATION: MISSION ANALYSIS DIVISION p 162-169 refs (See N71-10268 01-30)

18. SYSTEMS ANALYSIS: MISSION ANALYSIS DIVISION p 170-172 refs (See N71-10269 01-04)

N71-10285# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 237
28 Sep. 1970 89 p refs Transl. into ENGLISH from various Sino-Soviet publications
(JPRS-51452) Avail: NTIS

Abstracts of recent publications of the research in the Sino-Soviet Bloc countries are presented. Subjects include astronomy, meteorology, oceanography, and terrestrial geophysics. F.O.S.

N71-10287# General Accounting Office, Washington, D.C.
IMPROVEMENTS NEEDED IN THE MANAGEMENT OF AIRCRAFT MODIFICATIONS. DEPARTMENT OF THE ARMY (B-157373) Comptroller General's Report to the Congress
Elmer B. Staats 14 Jan. 1970 26 p ref
Avail: Issuing Activity

The procedures used in the aircraft modification program, and pertinent maintenance and aircraft log records were reviewed. It was found that modifications in many cases are not applied promptly, the volume of modification results in work loads beyond the capacity of maintenance activities, modification kits are apparently lost by local using units, and kits in some instances are not received in time for economical installation during overhaul of aircraft. It is recommended that delays be specifically justified, adequate controls be established to ensure proper approval procedures, management of aircraft modification be given immediate attention by the Army, and management controls be improved. N.E.N.

N71-10292# General Accounting Office, Washington, D.C.
REVIEW OF THE PROCEDURES AND PRACTICES FOR CONTROL OF MATERIALS UNDER THE APOLLO PROGRAM. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (B-158390) Comptroller General's Report to the Congress
Elmer B. Staats 8 Nov. 1968 39 p refs
Avail: Issuing Activity

The management of materials acquired by a prime contractor, North American Rockwell Corporation (NARC), for performance of contracts with NASA under the Apollo program was reviewed. NARC's accountability of materials during 1967 and early 1968 was covered as well as earlier situations relating to materials management. The effectiveness was examined of NASA's administration of the materials management aspects of the contracts and NARC's control over and disposition of contract materials. The review covered selected high-cost items on hand or in process of being procured for the Apollo program and was performed at the facilities of NARC at Downey and Seal Beach, California; NASA Headquarters, Washington, D.C.; the Marshall Space Flight Center, Huntsville, Alabama; and the Manned Spacecraft Center, Houston, Texas. The review did not relate to the contractor's overall property management responsibilities, such as those relating to the accountability and control over special tooling, test equipment, and other equipment acquired for government use in performance of the contracts under the Apollo Program. Author

N71-10299# Peat, Marwick, Livingston and Co., Washington, D.C.
NATIONAL INTERCITY TRAVEL: DEVELOPMENT AND IMPLEMENT OF A DEMAND FOR FORECASTING FRAMEWORK Final Report
Raymond H. Ellis and Paul R. Rassam Mar. 1970 149 p
Sponsored by Dept. of Transportation
(PB-192455) Avail: NTIS

The development and application of a prototype methodolgy for predicting national passenger travel demands are described. It specifically takes account of competition among four modes: air, rail, bus, and auto. Forecasts are prepared for the years 1975, 1980, and 1990. Author

N71-10355# Federal Aviation Administration, Washington, D.C. Aviation Policy Div.
SPECIAL STUDY: FAA PROGRAM EFFECTIVENESS AND

FACILITY CRITERIA INSTRUMENT LANDING SYSTEMS
Aug. 1970 95 p refs
Avail: NTIS

The problem of determining the extent to which a decision model should be pursued for the purpose of making ILS investment decisions is examined. Alternatives are presented from this viewpoint. The methodology presented for making ILS investment decisions represents the highest degree of sophistication which it is believed feasible to consider. Topics include: a recommendation that individual cost/benefits studies be required to support requests for ILS facilities; a definition of the recommended method for comparing costs and benefits; a definition of the parameters to be used and the methodology for estimating them (safety, time, cancellation/diversions, and all other benefits); and an examination of the analytical bases used in selecting parameters and methods.
Author

N71-10360# Federal Aviation Administration, Washington, D.C.
AIR PASSENGER SURVEY, SELECTED TABULATIONS. CLEVELAND-HOPKINS AIRPORT ACCESS STUDY
Jun. 1970 263 p ref
Avail: NTIS

Results are presented from a survey of airport users at the Cleveland Hopkins Airport before and after the opening of the Cleveland Transit System (CTS) rail transit service to the airport. Three origin and destination surveys were conducted to obtain information on both the trip to and from the airport and the trip maker for four groups of airport users. The user groups included air travelers originating or terminating trips at Hopkins, air traveler related visitors (meeting or sending off passengers), casual visitors (sightseeing, on business, buying tickets, or restaurant patrons), and employees. The number and percent of trips by mode and passenger residence, travel purpose, or land use at the local origin or destination of the trip are tabulated at district, cordon area, and census tract levels. The age, sex, income, purpose, duration of trip, land use at the origin or destination, and the means of access to or from the rapid transit system are shown by CTS station, passenger residence, and direction of travel. Maps of the CTS stations, districts, and census tracts are appended.
J.M.

N71-10370# Regional Planning Commission, Cleveland, Ohio.
SURVEY RESULTS: CLEVELAND HOPKINS AIRPORT ACCESS STUDY
Jun. 1970 187 p Sponsored by the Dept. of Transportation
Avail: NTIS

A statistical analysis was made of the mode of transportation to and from the airport before and after a direct rail rapid transit service was provided from the central business district to the airport. Among the findings are the following: 57.6% of the rapid transit riders are air passengers; 14.5% of the air passengers ride the rapid transit, including more than 25% of passengers with origin or destination in the transit service area; the use of private cars, taxis, and limousines decreased and the use of rented cars and courtesy vehicles increased; 4% of passenger-related visitors use the rapid transit; 8.4% of the airport employees rode a public bus to work prior to the transit opening and 11.2% rode the transit afterwards; and 17% of the riders are casual visitors.
N.E.N.

N71-10390# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Jan. – 31 Mar. 1970
31 Mar. 1970 85 p refs
(AD-710638; DME/NAE-1970(1)) Avail: NTIS CSCL 6/18

Contents: Assessment of the radiation hazards of supersonic transport; Comprehensive tidal study of the St. Lawrence River; Current projects of the Division of Mechanical Engineering and the National Aeronautical Establishment.
TAB

N71-10440# Regional Planning Commission, Cleveland, Ohio.
SURVEY PROCEDURES: CLEVELAND HOPKINS AIRPORT ACCESS STUDY
May 1970 123 p Sponsored by Dept. of Transportation
Avail: NTIS

The impact of the rapid rail extension from the central business district of Cleveland to the Hopkins airport was studied. The survey of the airport users was conducted in the following phases: (1) Data collection and processing prior to the opening of the rapid rail transit link to the airport. (2) Data collection and processing after the opening of the rapid rail transit link to the airport. Questionnaire design, and survey procedures are given. The results of the study are to be used to develop a model that can help assess the feasibility of rapid transit rail service to airports in other cities.
F.O.S.

N71-10466*# National Aeronautics and Space Administration, Washington, D.C.
BACKGROUND PRESS BRIEFING: US AND USSR COOPERATION IN SPACE: NEWS RELEASE
29 Oct. 1970 14 p
Avail: NASA Scientific and Technical Information Division CSCL 22A

A discussion on the possibilities for compatible rendezvous and docking arrangements between the U.S. and the U.S.S.R. is given in a news briefing. The discussion includes guidance systems, hardware equipment, and coordinate systems.
E.H.W.

N71-10511# National Bureau of Standards, Washington, D.C.
INSTITUTE FOR APPLIED TECHNOLOGY: TECHNICAL HIGHLIGHTS, FISCAL YEAR 1969
1969 27 p
Avail: Issuing Activity

Performance and other characteristics of products, systems, and devices were studied to find standards or a national concensus of measurement methodology. Outdoor exposure of building materials, wind effects on buildings, strength of inserts embedded in reinforced concrete slabs, occupancy loads in postal facilities, measurement of materials smoke generating characteristics, state building codes and standards, floor-surface resistance to movements of wheeled vehicles, performance tests of a prefabricated building, and field studies of air-cleaning systems in Post Offices are discussed. Electronic inhomogeneities and deep-lying trapping levels in indium antimonide are included as well as wire-bond evaluations, radiation damage in silicon nuclear detectors, thermal management, characterization of germanium for nuclear radiation detectors, and piezoelectric response of polymers. Systems analysis of Post Office Department mechanization projects, maritime consolidation centers, transportation simulation, Coast Guard operations, and urban studies projects are summarized. Motor vehicle safety in systems are covered including tires, occupant-restraint, and braking. Engineering materials, standards, and technical support activities are also covered.
J.M.

N71-10588# National Bureau of Standards, Washington, D.C.
INSTITUTE FOR BASIC STANDARDS: TECHNICAL HIGHLIGHTS, FISCAL YEAR 1969
[1970] 46 p
Avail: Issuing Activity

Technical work described provides the basis for a complete and consistent national system of physical measurements based upon the following six quantities: (1) mass; (2) length; (3) time; (4) temperature; (5) electric current; and (6) luminous intensity. Evaluated for their accuracy and practicality are physical, mechanical, and electrical quantities of international base unit standards as well as atomic and molecular properties of well defined substances in solid or gaseous forms; a program in applied mathematics and statistics supports the development of measurement techniques and the evaluation of obtained results.
G.G.

N71-10664# Progress Management Services, Arlington, Va.
THE OAR PROBLEM-ORIENTED COUPLING EXPERIMENT
Robert J. Massey 14 Feb. 1970 44 p refs
(Contract F44620-68-C-0065)
(AD-711389; OAR-70-005) Avail: NTIS CSCL 5/1

The objectives of the experiment were (1) to test problem research methodology developed in previous phases of the OAR Technological Barriers Documentation Project, and (2) to test the hypothesis that exposing Air Force scientists to specific technological problems would aid in coupling research to practical purposes. An advanced technological objective of a competitive, flight-weight magnetrohydrodynamic (MHD) electrical generator was analyzed to define specific technological problems whose solution would make development of the envisioned device feasible. These problems were documented on single-page Problem Resumes and selectively disseminated to scientists in OAR laboratories with a request to contact a given individual if they could contribute to illumination of the problems. Dissemination of problems and resulting technical feedback were not sufficient to be statistically significant. Results indicated, however, that specific research needs can be identified and documented at modest cost and that their selective dissemination to Air Force scientists is in the Air Forces interests. The report includes specific recommendations on exploitation of problem documentation and problem research. Author (TAB)

N71-10808*# Auburn Univ., Ala. School of Engineering.
UNISTAR: USER NETWORK FOR INFORMATION STORAGE, TRANSFER, ACQUISITION, AND RETRIEVAL Final Report
Oct. 1970 312 p refs Sponsored in part by the Am. Soc. for Eng. Educ.
(Grant NGT-01-003-044)
(NASA-CR-61333) Avail: NTIS CSCL 05B

The UNISTAR is an information management system (IMS) for scientific and technological information under the executive branch of the United States Government developed during a training exercise in the systems approach. This study indicates that: (1) A national policy on the goals and purposes of an information management system (IMS) must be established. (2) The National Aeronautics and Space Administration is in a unique position to provide leadership to develop an IMS for space-related data. (3) A useful IMS should assume an active as well as the usual passive role in handling information. Depositories, such as libraries, perform a passive role in the management of information in that the user must ask for information before it is forthcoming. It should be possible to actively encourage users to take advantage of the available information. (4) Equal emphasis should be placed on seeing that the educational community is well served by an active IMS. Author

N71-10816# Congress. House. Committee on Interstate and Foreign Commerce.
CIVIL AERONAUTICS BOARD AIR MAIL RATE AUTHORITY
Washington GPO 1970 71 p refs Hearings on H.R. 16879 before Comm. on Interstate and Foreign Com., 91st Congr., 2d Sess., 14-15 Apr. 1970 *Its* Serial No. 91-52
Avail: Subcomm. on Transportation and Aeron.

Discussed is a provision authorizing the postal authorities to contract with certified air carriers for the carriage of airmail by the filing of tariffs, and the resulting changes to the Civil Aeronautics Board air mail rate authority. G.G.

N71-10817# Congress. House. Committee on Science and Astronautics.
TOWARD A SCIENCE POLICY FOR THE UNITED STATES
Washington GPO 1970 121 p refs Rept. presented to Comm. on Sci. and Astronaut., 91st Congr., 2d Sess., 15 Oct. 1970 *Its* Serial S
Avail: Subcomm. on Sci., Res., and Develop.

The Subcommittee on Science, Research, and Development formulates recommendations for a national science policy and corresponding budgeting. The comprehensive effort outlines overall goals, objectives, and priorities, and analyzes the relationship between science and the current state of the nation. It is concluded that the continuing development of science and technology at an optimum rate is vital and can be best stated and maintained by public law in the operations of every department or agency of the U.S. Government which utilizes science and technology in its mission. G.G.

N71-10818# Oak Ridge National Lab., Tenn. Ad Hoc NEL Concept Committee.
THE CASE FOR NATIONAL ENVIRONMENTAL LABORATORIES
Washington GPO Jan. 1970 45 p refs Presented to Senate Comm. on Public Works, 91st Congr., 2d Sess., 13 Feb. 1970
Avail: Comm. on Public Works

Developed is the thesis of organizing certain institutions more meaningfully to match science and technology to national environmental and technological assessment problems. The organizations envisaged, National Environmental Laboratories, would have interacting components from many physical and social sciences. By their structure and method of working, they would be able to cut across the fabric of environmental problems. Author

N71-10873# RAND Corp., Santa Monica, Calif.
QUANTITATIVE METHODS OF STUDYING THE DEVELOPMENT PROCESS OF SCIENCE
V. V. Nalimov Jul. 1970 24 p Transl. into ENGLISH from Vopr. Filosofii (USSR), v. 20, no. 12, Dec. 1966 p 38-47
(AD-711248; LT-70-4) Avail: NTIS CSCL 5/6

The purpose of this paper is to show that with the aid of science-metrics some interesting results, important from the practical standpoint, have already been obtained, and to discuss those tasks which it is possible to solve in the nearest future. Author (TAB)

N71-10900*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FY 1970 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
Sep. 1970 85 p
(NASA-TM-X-66474; A/TS-MS-I-70-01) Avail: NTIS CSCL 05B

Formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 70 are presented with papers of MSFC contractors. Author

N71-10930# Illinois Univ., Urbana.
COORDINATED SCIENCE LABORATORY Progress Report, Jul. 1969-Jun. 1970
1 Aug. 1970 368 p refs
(Contract DAAB07-67-C-0199; Grant AF-AFOSR-1579-68)
(AD-711278) Avail: NTIS CSCL 9/3

The report covers research in the following fields: Surface physics; Applied physics; Plasma physics; Rarefield gas dynamics; High voltage breakdown; Space and atmospheric sciences; Semiconductor physics; Computer; Plasma display; Urban development; Information science; Networks; Control systems; Switching systems; Cognitive memory; Seismic vehicle detection; Engineering aids for the handicapped; Photochromic memory for computer applications; and, Information retrieval. TAB

N71-10977# National Science Foundation, Washington, D.C.
RESEARCH AND DEVELOPMENT IN STATE GOVERNMENT AGENCIES Fiscal Years 1967 and 1968
May 1970 103 p refs

(NSF-70-22) Avail: SOD $1.00

Increased emphasis has been given to the role of State governments in solving the many problems of modern society—cultural, economic, social, and environmental. The current report shows a great increase in State agency expenditures for research and development between 1964 and 1968, and reflects the interest of many State agencies in new approaches, techniques, and methods of coping with specific problems such as air and water pollution, mental disease and retardation, educational deficiencies, crime, and many other problems. Author

N71-10980*# Stanford Univ., Calif. Inst. for Plasma Research.

A THEORY OF THEORIES

P. A. Sturrock Jul. 1969 37 p refs

(Grant NGR-05-020-272; Contracts F44620-69-C-0008; N00014-67-A-0112-0006)

(NASA-CR-111335; AD-697780; SUIPR-324) Avail: NTIS CSCL 05F

The aim of the document is to set out a bookkeeping procedure by which a scientist (using the term flexibly) may compare the conclusions of a theory with facts obtained by reduction of observational data with the aim of assessing the hypothesis on which the theory is based. It is argued that the appropriate formalism is probability theory, and that the key process is the inductive process as represented by Bayes theorem which indicates how the degree of belief in a hypothesis should be adjusted in response to new information. The following model of the inductive process in science is adopted. Between observation and theory there is an interface which comprises a set of independent items: each item comprises a complete set of mutually exclusive statements. It must be possible to assign two probabilities to each of these statements, one by reduction of observational data, and the other by theoretical analysis of the considered hypothesis. Formulas are derived which show (a) how the assumed probability of the hypothesis should be adjusted in response to information concerning one item, and (b) how such estimates concerning more than one item may be combined. The method is illustrated by a worksheet indicating the way in which a few observational facts about pulsars may be used to appraise both the neutron-star hypothesis and the white-dwarf hypothesis. Author (TAB)

N71-10983*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

[WAVE PROPAGATION, ELECTRON AND SOLID STATE PHYSICS, AUTOMATIC CONTROL, ELECTRONIC NETWORKS, AND ELECTROMAGNETIC PHENOMENA]

Semiannual Progress Report, 1 Jan.–30 Jun. 1969

Dec. 1969 69 p refs Sponsored in part by NASA, AF, Army, ARPA, and NSF

(Contract N00014-67-A-0298-0006)

(NASA-CR-111352; AD-702417; SAPR-78) Avail: NTIS CSCL 09C

Research activities in electron and solid state physics center on optical properties of lasers and electronic qualities of rare earth crystals. Systems analysis and control of adaptive and physiological systems are considered and control optimization problems in navigation and mathematical programming are outlined. Models are formulated for nonzero-sum differential games and research continues on stochastic differential games. Two class pattern recognition is applied to EEG data evaluation and a probabilistic learning scheme is suggested that uses reproducing density functions. The design of a physiological voltage membrane clamping system is described. Work with ferromagnetic and ferroelectric materials encompasses electromagnetic characteristics of antennas and antenna arrays and the effects of dielectric, conducting, and plasma media on antenna transmission. G.G.

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NEW NASA PUBLICATIONS

Proceedings of the Seventh Annual Meeting of the Working Group on Extraterrestrial Resources (NASA SP–229)

The Working Group on Extraterrestrial Resources (WGER), which held its seventh annual meeting in Denver, Colorado, June 17–18, 1969, in conjunction with the joint national meeting of the American Astronautical Society (AAS) and the Operations Research Society (ORSA), draws its membership from among scientists and engineers of NASA, the U.S. Air Force, the U.S. Army, and the U.S. Bureau of Mines who have an active interest in the usable resources of extraterrestrial bodies, in order, primarily, to reduce dependence of lunar and planetary exploration on terrestrial supplies.

The *Proceedings* is expected, like previous volumes, to serve as a valuable reference in the field of extraterrestrial resource exploration and exploitation. *Paperbound.* 152 pp. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.50.

Hydrogen Leak and Fire Detection (NASA SP–5092)

By B. ROSEN, V. H. DAYAN, AND R. L. PROFFIT

A Technology Utilization Survey prepared under contract for NASA by Rocketdyne, a division of North American Rockwell Corporation. The research was undertaken to consolidate information on the detection of hydrogen leaks and hydrogen fires. The booklet contains a critical review of applicable literature, a discussion of the experiences and needs of typical producers and users of hydrogen, an evaluation of the present technology of hydrogen fire and leak detection, and recommendations for further efforts in research and development. *Paperbound.* 96 pp. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 45 cents.

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